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ABSTRACT

Any consideration of the status of science and mathematics education at the upper secondary school level in Australia must take into account the range of courses offered and the number of students enrolled in the different courses. This monograph describes science and mathematics curricula at national and state levels, and provides full enrollment information from 1970-1985 for upper secondary biology, chemistry, geology, physics, physical science, general science, environmental studies, agriculture, mathematics, and computing studies. Interesting features of the enrollment patterns are highlighted and discussed, while the final chapter is devoted to an analysis of the implications of the trends in Australian science and mathematics education. A bibliography contains journal articles and books categorized as general, science, and mathematics. Data sources from seven states, and their documents, are provided. (YP)

# UPPER SECONDARY SCHOOL SCIENCE AND MATHEMATICS ENROLMENT PATTERNS IN AUSTRALIA, 1970-1985



J. Dekkers ■ J.R. De Laeter ■ J.A. Malone

# UPPER SECONDARY SCHOOL SCIENCE AND MATHEMATICS ENROLMENT PATTERNS IN AUSTRALIA, 1970-1985

JOHN DEKKERS
Capricornia Institute, Queensland.

JOHN R. De LAETER and JOHN A. MALONE
Western Australian Institute of Technology

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# FOREWORD

Any examination of the status of science and mathematics education at the upper secondary school level in Australia must take account of the range of courses offered and the number of students enrolled in the different courses.

Much of this information has been available at the State level, usually contained in the annual reports of the agencies responsible for the conduct of public examinations at the Year 12 level. This report addresses the issue from a national perspective, bringing into one convenient volume the information from all States and Territories for 1970 to 1985.

Since the information is so comprehensive, it enables various comparisons to be made. For example:

For a given State, what are the relative enrolments in different science courses?

For a given State, what are the trends in enrolments across time for a given course?

For a given course, what are the differences across States?

Underlying the monograph is a concern that all students at the upper levels of secondary school in Australia should have the opportunity to undertake science and mathematics courses that are relevant and challenging, but which take account of varying levels of interest and ability.

Science and mathematics serve two purposes within the curriculum at this level. On the one hand, a thorough introduction to both of these curriculum areas is needed as part of a well-rounded general education for all students. In addition, major studies in selected aspects of science and mathematics are needed as prerequisites for those students who wish to follow careers in scientific or technical fields after they have left secondary school.

In interpreting the data in the report, the authors have noted the relatively low enrolments in physics and chemistry, especially by girls. The report also shows the increasing range of courses available at this level.

The report stands as a challenge to teachers and administrators and others responsible for planning education at the upper secondary level. They are invited to look at their own current situation in the light of the overall picture provided by these data, and to consider how best to enhance the quality and quantity of science and mathematics education provided in Australian schools.

*Malcolm J. Rosier*
*Chief Research Officer, Australian Council for Educational Research, Hawthorn*

*June 1986*

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# PREFACE

Since the mid-1960's, continuing public and political debate has taken place regarding the decline in the relative numbers of secondary students taking science and mathematics in Australia and other western countries. Much of this debate was generated by the belief that educated persons everywhere should be informed and knowledgeable about scientific and technical issues that can directly affect the quality of human life.

More recently in Australia, the debate has focussed on the trends in technological development and applications, and the implications of these trends on education and schooling. A number of reports and Government-sponsored committees of review as listed in the Bibliography (e.g. Australian Committee of Inquiry into Technological Change (Myer Report), 1980, CTEC (Learning and Earning Report), 1982; Williams et al. 1980) reveal that:

- Secondary school retention rates, though increasing, compare unfavourably with those of other industrialised nations, for example the United States and Japan;
- Secondary school students fall into the following categories:- Approximately 25% complete Year 12 and then proceed to tertiary studies; 15% complete Year 12 and do not proceed to tertiary studies; 20% complete Year 11 and do not proceed to Year 12 and 40% leave school at the end of Year 10;
- An increasing number of females are remaining at school until Year 12, but a considerable proportion do not take science and the more rigorous mathematics subjects.

There is also evidence that many of the more academically able students are opting for non-science based careers as is reflected in the relatively static enrolments at tertiary institutions for science and engineering courses. An exception is the field of computing.

Current developments and advances in technology will continue to affect youth, education, employment patterns and leisure time. Coping with and planning for developments in science, technology and societal aspirations requires informed debate on factual information. Unfortunately, much of the past debate concerning school science and mathematics has focussed only on the appeal of these subjects to students When examining this issue it is also necessary to consider students enrolments in these subjects in the final years of secondary school in order to discern trends.

Consequently, this monograph has a three-fold purpose:

- to present an overall account of developments in upper school science and mathematics subjects in Australia and to address the implications of current enrolment trends;
- to establish a data base for upper secondary school science and mathematics enrolments;
- to provide a source of reference works in the area of upper secondary school science and mathematics enrolment patterns and trends.

The upper secondary school science and mathematics enrolment data is for the sixteen-year period (1970-1985). Enrolment data and trends for the decade 1970-79 are described in a number of publications by Dekkers, De Laeter and Malone (see Bibliography). This information can be set against other data collated by Dow (1971) for science, and Rosier (1980) for mathematics, to permit an examination of enrolment trends in Australian Secondary Schools over the past 25 years.

The authors would like to thank the educational authorities from each of the States and the Australian Capital Territory (ACT) for providing the data upon which this monograph is based, and the Australian Bureau of Statistics which provided the school enrolment data. It should be noted that the South Australian statistical data include students from the Northern Territory. The following State Authorities provided science, mathematics and computing subject enrolment data:

| | |
|---|---|
| Queensland | — The Board of Secondary School Studies |
| New South Wales | — The School Statutory Board, Department of Education |
| ACT | — Australian Capital Territory Schools Authority |
| Victoria | — The Victorian Institute of Secondary Education |
| Tasmania | — The Schools Board of Tasmania |
| South Australia | — Senior Secondary Assessment Board of South Australia |
| Western Australia | — Secondary Education Authority. |

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*J. Dekkers*
*J.R. De Laeter*
*J.A. Malone*

*June, 1986.*

CHAPTER 1

# SCIENCE AND MATHEMATICS CURRICULA IN AUSTRALIAN SECONDARY SCHOOLS

## 1.1 NATIONAL OVERVIEW 1965-1985

Because of Australia's historical link with Britain, science and mathematics curriculum development in this country was originally modelled upon British ideas. The mechanism of change was either to prepare materials which reflected overseas ideas or to adapt overseas materials. In many cases these ideas and materials were brought into Australia by science and mathematics educators from overseas - for example Gattengo and Dienes in mathematics - or they were generated from within by such influential educators as Wyndham (NSW), Radford (Qld) and Vickery (WA). From the mid-1960's onwards however, Australian science education and to a lesser extent mathematics education, turned away from the traditional British model to those of the United States where the post-Sputnik curricula, developed with massive injections of funds by very talented teams of educators, produced materials that could not be ignored.

### Lower Secondary

At this level, the discipline-oriented study of science used until the late 1950's was not only updated to include recent applications and developments in science, but an interdisciplinary integrated approach to the study of science was utilised that emphasised the inquiry and problem-solving nature of the subject. In addition there was an emphasis on process, content and skills development. Relevance to the environment, man and society were the pervading themes in school science syllabi.

When compared to the 1950's, the significant change that occurred in science education during the 1960's and early 1970's was the adoption by schools of junior science curricula that originated in the UK and USA. For example, in the UK there were the **Integrated Science Project** (Schools Council, 1968) and the **Nuffield Combined Science** (Nuffield Foundation, 1968) materials, whilst from the USA there was the **Science Curriculum Improvement Study** (SCIS, 1972) materials that were trialled in Australian schools. However, many of these curricula soon proved unsuitable for Australian students due to their unfamiliar content, cultural differences and lack of access to materials for class activities. This resulted in an unparalleled wave of curriculum project development within Australia that has yet to be repeated. Most prominent of the early junior science curriculum developments were **Science for High Schools** (NSW Department of Education, 1965), **Junior Secondary Science Project** (JSSP, 1969) and the **Australian Science Education Project** (ASEP, 1974).

Towards the end of the 1970's and in the early 1980's, the trend was for teachers to develop local and State-based curriculum materials that better met the needs and demands of students. In order to facilitate this development of school-based science materials, the subject documents made available to teachers by the respective Department of Education in each State were used as a framework for curriculum development. In addition, guidelines for curriculum development were available, and in a number of States the Department of Education became actively involved in materials development. For example, the Western Australian Department of Education Curriculum Branch developed a complete science curriculum for Years 8 to 10 for consumption by the public and private school sector (W.A. Department of Education, 1971), whilst in South Australia the Education Department produced a **Do it yourself curriculum guide for Secondary Science** (Education Department of South Australia, 1977).

Concerning mathematics, the content of the lower secondary syllabus prior to the end of the fifties consisted of arithmetic along with elementary algebra. Speed and accuracy with the four arithmetic operations was the goal, while extensive work on applications of basic arithmetic was also a priority. As the decade ended, however, Australian mathematicians and teachers had become influenced by the activities of their counterparts overseas - particularly by the Southampton-based **School Mathematics Project** (Thwaites, 1972), the work of the University of Illinois Committee on School Mathematics (NCTM, 1963) and, somewhat later, the output of the School Mathematics Study Group (Begle, 1968). Blakers (1978) describes how Australian educators joined the growing world-wide trend to re-examine the content of school mathematics courses so as to place greater emphasis on understanding and structure. However, few of the programs developed overseas were adopted intact. Much was unsuitable for direct adoption because of cultural and linguistic problems, or because it had been prepared for students in a narrower ability range than that found in Australian classrooms. This process of adaption was extremely useful because it involved many teachers and administrators in thinking critically about the mathematics content and teaching methods involved.

At present the lower secondary program still contains basic arithmetic but with less emphasis on skills and more on structure; sets are included, together with geometry, elementary probability and statistics - changes which paralleled overseas developments. Prior to that, the Nuffield Project (Howson, 1978), had the effect of lessening formalism and promoting a swing to problem-solving, the latter phenomenon possessing somewhat of a "bandwagon" emphasis at the end of the 1970's and into the 1980's, due mainly to the recommendations of the U.S. National Council of Teachers of Mathematics (NCTM) described in **Agenda for Action** (NCTM, 1980). Curricula developed overseas - for example the Nottingham materials entitled **Journey into Mathematics** by Bell et al., (1979); the **Development of Ideas in Mathematics Education** (DIME) project (Giles, 1978) - and the Australian project, **Reality in Mathematics Education** (RIME) Lowe (1980), continue to be influential at this time.

## Upper Secondary

During the mid-to-late 1960's, science curricula changed considerably. It was a period in which there occurred the complete adoption of overseas courses, adaptation and development of courses in Australia at a national level. Most overseas courses were developed by a massive injection of funds provided by government, commerce and industry and were far superior to those which existed in Australia at that time. Physics courses introduced were the **Physical Science Study Committee** (PSSC, 1965), **Project Physics** (Project Physics, 1965) and **Nuffield Physics "A" and "O" levels** (Nuffield Foundation, 1966). Chemistry courses introduced included **Chemical Bond Approach** (CBA, 1964), **Chemistry - an Experimental Science** (Pimentel, 1963), **Nuffield Chemistry "A" and "O" levels** (Nuffield Foundation, 1967). New biology courses included **Biological Science Curriculum Study** (BSCS, 1962) and the **Nuffield Biology "A" and "O" levels** (Nuffield Foundation, 1965). A new geology course entitled: **The Earth Science Curriculum Study Project** (ESCP, 1968) was also introduced.

Whilst many of the US and UK materials introduced into Australian schools are still extensively used, much of the content proved either unsatisfactory or unsuitable. This was particularly so for Biology, and resulted in the Australian Academy of Science (AAS) making a significant contribution to the reform of science curricula in Australian schools. The Academy had been responsible in the early seventies for the adaptation of the American BSCS biology course, **Biological Science - The Web of Life** (Morgan, 1978), and has more recently introduced the new chemistry course **Elements of Chemistry** (Watts, 1983) and the geology course, **Geological Science: Perspectives of the Earth** (Clark, 1983). Besides the efforts of the AAS, there has also been a significant number of other national, state and locally developed senior science materials - for example, **National Science Curriculum Materials** (Meyer, 1971), **Physical Science Course** (Western Australian Department of Education, 1978) and **Chemical Science** (Hunter et al, 1980).

If the lower secondary mathematics program of the Australian school system in the early 1960's was characterised by the presence of arithmetic, drill and practice, the upper secondary program was characterised by the absence of arithmetic. More algebra, some trigonometry and formal geometry, analytical geometry, probability and statistics and introductory calculus generally constituted the syllabus for the final two years of study. The late 1960's had witnessed the introduction of the "new mathematics" which brought with it changes in content and attitudes. In algebra and geometry, greater emphasis was placed on the careful use of language, and the study of probability and statistics was emphasised at the expense of teaching formal Euclidean geometry. In many States, "advanced" topics such as complex numbers, matrices and elementary number theory were being included in the syllabi of the upper secondary school

Two events exercised a profound influence on the development of mathematics in the upper secondary school in Australia in the 1970's The first involved a striking increase in the proportion of the age group completing a full 12 years of primary and secondary schooling, and the second concerned the proliferation of mathematics units available to students as they progressed into the final two years of their schooling. The unemployment situation at the time undoubtedly influenced the first of these events, and an increasing number of female students enthusiastically selected the new units as the myth which identified mathematics as a male-dominated subject was dispelled. The wider "menu" of units had originated in the realisation that mathematics had an important role to play in an ever-increasing number of different fields of study - social science, health science and business studies, as well as in the related and explosively-developing field of computing studies.

The effect of this wider "menu" is that now virtually every student in the upper secondary school studies some type of mathematics unit. The opportunity now exists for students to take a "strong" mathematics programme - in some States students may devote 40% of their time over two years to the study of mathematics. It is a fact, however, that the number of students taking the "strong" mathematics programme has declined over the past 10 years.

## 1.2 STATE PERSPECTIVES

Throughout Australia, the subject syllabi for the different science and mathematics courses generally bear a strong similarity, though the range of subjects, certification and mode of subject assessment varies considerably from State-to-State. In all States and the ACT, upper secondary school subjects are preferentially selected by students. The basis for selection ranges from tertiary entrance requirements to peer group influence. Students are not required to take either a science or mathematics subject to graduate from upper secondary school.

The "Background" sections which follow briefly trace syllabi developments in each State since 1970. Details on courses of study, certification procedures and subject availability in each State are also provided. All information is based on literature available from each State and the authors acknowledge drawing materials from these sources (as listed in the Bibliography).

## QUEENSLAND

### Background

In 1970, the Public Examination for full-time students was replaced by school assessment and moderation procedures with the introduction of the Radford system. At the same time the Board of Secondary School Studies (BSSS) was set up as a statutory body with responsibilities which included the development of syllabi for subjects accredited on the Junior and Senior certificates. The worldwide revolution in science and mathematics curricula, the Radford Report (1970), the Scott Report (1978) and the Report of the Parliamentary Select Committee on Education in Queensland (1980) have similarly affected the science and mathematics curriculum.

As a consequence of the above developments, new syllabi for lower and upper secondary science and mathematics have been progressively introduced from the late 1960's until the present.

For Years 11 and 12 science, the approach remained for the most part discipline-oriented with separate offerings being available in Chemistry, Physics, Biological Science and Earth Science. An exception to the discipline-oriented approach was the introduction of Multistrand Science in 1980 - a less rigorous, multi-disciplinary subject which has become increasingly popular with students in Years 11 and 12.

Revision of upper secondary mathematics resulted in the preparation of 11 units - Preparatory Mathematics, Calculus I, Algebra and Calculus II, Complex Numbers, Computer Mathematics, Financial Mathematics, Matrices and Vectors, Mechanics, Probability and Statistics, Trigonometry and Analytical Geometry and Modern Algebra. Students had the option of studying up to a maximum of 8 units over Years 11 and 12. In 1976, Social Mathematics was introduced as a less rigorous alternative to the 11-unit offering. In 1983 another subject, Mathematics in Society, was introduced.

Upper secondary mathematics subjects now offered are Mathematics I, Mathematics II, Social Mathematics and Mathematics in Society. Mathematics I consists of any 4 units from the original 11 units, while Mathematics II consists of a further 4 units from the list of 11 units. Schools have some choice in the units which will comprise Mathematics I and Mathematics II. In the subject Mathematics in Society, the scope and approach is seen to be less rigorous than that of Mathematics I, Mathematics II and Social Mathematics.

### Course of Study and Certification

In Years 11 and 12 students have a wide choice of subjects that lead to the award of a Senior Certificate. Syllabi for subjects are presented as semester units which can be chosen by students according to their interests, abilities and need for tertiary studies. In the case of science and mathematics subjects, most of these are structured into semester units which follow a sequential development of subject matter to an in-depth level

### Subject Levels

Subjects studied are either Board Subjects or School Subjects. Board Subjects are approved by the Board of Secondary School Studies and are taken by students who intend to pursue tertiary studies. Syllabi for these subjects contain a broad framework of the subject matter, content and objectives, and the schools use this framework to design the subjects in which they have freedom in matters of course content and teaching strategies. Within the guidelines of the subject moderation system, teachers can design their own assessment procedures to measure student performance The examination results of all Board subjects are further moderated by student performance on the Australian Scholastic Aptitude Test (ASAT).

Syllabi for School Subjects are developed by an individual school on its own initiative Assessment of School Subjects does not require the moderation procedure

### Subjects

Board science subjects are: Biological Science, Chemistry, Earth Science, Physics, Multistrand Science, Agriculture and Animal Production.

Board mathematics subjects are: Mathematics I, Mathematics II, Social Mathematics and Mathematics in Society.

## NEW SOUTH WALES

### Background

Students remaining at school to complete the final two years of secondary education sit for the Higher School Certificate Examination at the end of Year 12.

The Higher School Certificate courses of study were, until 1975, organised by subject in a hierarchy of levels of ability. There were three levels offered for study in most subjects: First Level - which was considered an honours level course; Second Level - which in scope and difficulty was considered to be an adequate basis for further study of the subject beyond the secondary school, and Third Level which, although adapted to and challenging the abilities of students at this level, was considered as a terminal level. The exceptions to this were mathematics and science, which, in effect, could be studied at four levels - First, Second (Full), Second (Short) and Third Level. Mathematics and science taken together at First Level or Second (Full) Level were entitled to count as three subjects. The students' aggregate mark on their best five subjects (actually the best-10 half subjects because of the structure of mathematics and science) was used as the basis for tertiary selection.

A new curriculum was introduced in 1975 for Year 11 students which involved new programs of study designed to cater for the wide variety of purposes and interests found among these students. These programs carried through into Year 12 and were examined for the first time in the 1976 Higher School Certificate Examination. Under the new system, the concept of levels, with its emphasis on an hierarchy of ability, was abandoned. In the process, the notion of different mark values for different levels of study disappeared. Under the former system many candidates studied at levels at which they were unable to achieve success, believing that they would gain additional marks and be conceded passes at a lower level should they fail. However, under the new system there were no conceded passes and all units were of equal mark value. The new framework was designed to promote freedom and flexibility of approach to the curriculum, and the Board of Senior School Studies envisaged the development of course patterns of great variety. Those candidates who wished to make selections aimed at further studies at the tertiary level were free to do so but, equally, there was an opportunity to select a very broad educational program. In other words, selection was to be determined by the student rather than by the system, and specialization was available purely as a matter of choice.

The restructured curriculum was organized on the basis of units of study. Each unit represented two hours of study per week and made possible the gaining of 50 examination marks. Courses were named in accordance with the unit system and, in each case, their purposes were stated.

In 1982, the Board of Senior School Studies advised schools of changes to procedures for the 1983 Higher School Certificate Examination resulting from a restructuring of the HSC courses. This restructuring involved changes to the 3 Unit courses so that they incorporated the whole of their related 2 Unit courses and, where warranted, the provision of new separate 2 Unit courses.

### Courses of Study and Certification

Studies in science and mathematics are of two years' duration and successful completion leads to the award of the Higher School Certificate (HSC).

### Subject Levels

Upper secondary school subjects are either HSC subjects or "Other approved Studies". HSC subjects are externally examined subjects and are offered on a unit basis.

*3 and 4 Unit Subjects*

— the subjects are intended as preparation for study of that subject at the tertiary level. Treatment of the subject is at a more in depth level than for the 2-unit course. The 4 unit course in mathematics was developed as a demanding course and intended specifically for those with a very marked interest in the subject.

*2 Unit Subjects*

— these subjects meet general needs and are suitable for those whose intended tertiary studies would require some mathematical understanding.

*2 Unit A Subjects*

— these subjects are general in content and not intended to serve as preparation for study of that subject at a tertiary level.

"Other Approved Studies" are subjects assessed by the school itself and do not contribute to the Higher School Certificate aggregate mark, which is used for selection purposes by tertiary institutions.

### Subjects

HSC science subjects are: 4U Multi-Biology, 4U Multi-Geology, 2U Biology, Chemistry, Geology, Physics and 2UA Science.

HSC mathematics subjects are: 4U, 3U and 2U Mathematics, 2U Mathematics and Society and 2UA Mathematics.

## AUSTRALIAN CAPITAL TERRITORY

### Background

The period 1975-1980 spans those years during which the New South Wales Higher School Certificate Examination (HSC) was phased out in the Australian Capital Territory (ACT) and the ACT Year 12 Certificate was introduced.

Concurrent with this change, ACT schools (the Canberra Grammar School excepted) replaced the NSW centrally-prepared syllabus and issued syllabi with teacher-developed courses accredited by the ACT Schools Accrediting Agency. External examinations were replaced by teacher assessment The last HSC examination was conducted in 1976 and the first ACT Year 12 Certificates were awarded in 1977.

The introduction of the Year 12 Certificate coincided with the opening of government secondary colleges for senior (Years 11 and 12) students in the ACT and an increase in the number and variety of courses offered to students. There were also changes in the way courses were structured.

In 1975, HSC science and mathematics courses were offered at four levels - Level 1, Level 2 Full, Level 2 Short and Level 3. The periods allocated for the study of these courses varied. In Year 12, students studied Level 1 courses for 11 periods, Level 2 Full for 9 periods and Level 2 Short and Level 3 for 6 periods; each period was of 40 minutes duration. Level 1 was the most difficult of the science courses, Level 3 was the least difficult. In all science courses students studied physics and chemistry and either biology or geology.

In 1976, HSC course structures were changed. A number of school-based mathematics subjects became available, while science subjects were offered as 4 Unit, 2 Unit and 2 Unit A courses. Four unit courses were multi- strand courses comprising physics, chemistry and biology or geology. Year 12 students studied 4 Unit courses for twelve - 40 minute periods each week. Physics, chemistry, biology and geology were each offered as 2 Unit courses and were studied either independently or in pairs as a double-strand science course. The 2 Unit courses were studied for six - 40 minute periods each week. The 2 Unit A course was a lower level general science program studied for six - 40 minute periods each week.

In 1976, ACT Year 11 students commenced studying ACT accredited science and mathematics courses. These courses were composed of units, a standard unit being defined as 4 hours tuition for 12 weeks or one term. Units were arranged to form minor (3 unit) or major (5 unit) courses. In mathematics and science, major minor (8 unit) and double major (10 unit) courses were also formed. Minor courses were completed in one year, either in Year 11 or Year 12 Many students studied 6 terms when completing a major. Almost all major courses consisted of at least 6 units.

All science and mathematics courses were accredited, and most have been classified as Tertiary Entrance Score (TES) subjects by the Australian National University (ANU). When a course was accredited it was judged by a panel of subject matter experts, and the ACT Schools Accrediting Agency, to be educationally sound and appropriate for the students for whom it was intended. Those accredited courses which have been TES Classified have been judged by that University to possess the level and kind of reasoning and thinking appropriate to those courses studied by students intending to proceed to a tertiary institution after completing Year 12. For example, in 1983 the school-based mathematics subjects were classified as either Mathematics 1 (specialised, leading to tertiary studies in mathematics). Mathematics 2 (providing adequate background for tertiary studies in which the mathematics content is minimal) and Mathematics 3 (a terminal mathematics course).

### Course of Study and Certification

The ACT Schools Authority's commitment to school-based curriculum development has resulted in the availability of a wide range of science and mathematics subjects in Years 11 and 12 in each secondary college. In order that there is a maintenance of ACT-wide comparability of academic standards and quality of courses, each college uses the Authority's credential system to accredit each course separately.

At the completion of Year 12, students are issued with a Year 12 Certificate which is awarded on the basis of all courses completed during Years 11 and 12.

### Subject Levels

A course constitutes a combination of units with coherence of purposes in a particular subject area. There are 4 types of courses:

| | |
|---|---|
| Double Major Course | — A double major course contains 10 or more standard units. |
| Major/Minor Course | — A major/minor course contains 8 or 9 standard units. |
| Major Course | — A major course has 5-7 standard units. |
| Minor Course | — A minor course has 3 or 4 standard units (1 unit is 44 hours of timetabled class time). |

Courses fall into three types of categories: Registered courses, Accredited courses and Tertiary Entrance Score (TES) classified courses.

A Registered course is one with a set of related learning experiences that are appropriate for students in Years 11 and 12 and which are usually designed to further the students' social, artistic, sporting and/or personal development, or to assist students having difficulties in an academic program. Registered courses are approved by the secondary college or school board and then placed on the public register. Registered units stand alone or form part of a registered course.

An Accredited course is one which has been accepted by the secondary college or school board, considered by a course panel appointed by the ACT Schools' Accrediting Agency, and approved by the Agency as being educationally sound and appropriate for students studying in Years 11 and 12. Accredited units form part of an accredited course.

A TES classified course has been accredited as described above and approved separately by the Australian National University for use in calculating the Tertiary Entrance Scores (TES). A course of this type requires study at an intellectual level compatible with success in tertiary studies, and/or is designed so that it forms a sound foundation for continued study of a particular discipline at tertiary level. The units form part of a TES classified course.

### Subjects

Tertiary accredited science subjects are: General Biology, Web of Life, Chemistry, Geology, Earth Science, Physics, Physical Science, Agriculture, Health, Photography, Food Studies, Electronics, Environmental Studies, Oceanography, General Science, Multidisciplinary Science, Applied Science, Technology, Astronomy.

Tertiary accredited mathematics subjects are: Mathematics 1, Mathematics 2, Mathematics 3, Computing.

## VICTORIA

### Background

At the completion of Year 12 students are awarded the Higher School Certificate. Prior to 1976, matters relating to upper secondary curricula and awards were the responsibility of the State Education Department. However, in 1976 the Victorian Institute of Secondary Education (VISE) was established as an independent statutory body. Its responsibilities include assistance and advice on school curricula and the accreditation and external assessment of subjects Since its inception VISE has also had an active advisory role in curriculum development and the assessment of the Year 12 course.

In 1978, VISE Council released a **Policy statement on curriculum and assessment in Year 12.** This statement provided details of changes to the Year 12 course of study to take effect from the beginning of 1981. An effect of this policy has been a considerable expansion and diversity of curriculum offerings in Year 12.

### Course of Study and Certification

Two groups of courses are offered by VISE for certification purposes: Group 1 subjects and Group 2 courses which may be subjects, single units or approved structures. Group 1 subjects are subjects prepared by the school and approved for study by VISE. All these subjects are school assessed but are moderated by VISE. Group 2 studies are externally examined through VISE and form the basis for tertiary studies.

Three different types of elements may make up a Year 12 course: units, subjects or other approved structures accredited by VISE:-

- A unit is an element of study of approximately 35 to 40 hours of class time. Units may be studied singly or in combination, according to the terms of accreditation.
- A subject consists of three mutually-related units or their equivalent. A student may undertake school-prepared and assessed subjects and/or externally examined subjects.
- Other approved study structures may include wholly integrated courses of study which may be accredited as equivalent to a particular number of units.

All courses of study at the upper secondary school level are approved and controlled by the Victorian Institute of Secondary Education. Specific details are outlined in the **VISE Handbook for Year 12 Curriculum and Assessment** *(see Bibliography).* Completion of the Year 12 course leads to the award of the Higher School Certificate (HSC).

### Subject Levels

A Year 12 Higher School Certificate course consists of an approved study structure of 12 units comprising Group 1 subjects or Group 2 subjects plus Group 1 English, or an approved alternative, and no more than three Group 2 single units.

## Subjects

Group 2 science subjects are: Biology, Chemistry, Geology, Physics, Physical Science, Environmental Science.

Group 2 mathematics subjects are: Pure Mathematics, General Mathematics, Applied Mathematics, Computer Science.

# TASMANIA

## Background

Following proposals of the Schools' Board of Tasmania and the Radford Report (1970), a number of changes to upper secondary education progressively came into effect.

In 1969, the Board became the sole examining and certifying body at the secondary level and for the first time conducted the Higher School Certificate Examination. The examination replaced the Matriculation examination previously conducted by the University of Tasmania. Over a period of time there has appeared a greater diversity of subject offerings and breadth of awards and assessment procedures for specific subject areas.

## Course of Study and Certification

The Higher School Certificate is available to students at the end of both the fifth and sixth years of secondary education (equivalent to Years 11 and 12). The HSC is awarded to any candidate who passes School Board approved subjects at Level II . The results of the HSC assessments conducted by the School Board of Tasmania are used by the University of Tasmania in determining the requirements for matriculation.

## Subject Levels

At present, most subjects are available at two levels - Level II and Level III. Level III indicates a higher academic level than Level II. Students need not attempt a subject at Level II before proceeding to study at Level III. Syllabi in subjects areas offered at Level II, where a Level III syllabus also exists, provide for those who wish to take a terminal course in a subject, as well as for those who require a foundation course before proceeding to the study of a Level III subject.

Assessment of Level III subjects is a combination of an external examination component and a standardised school assessment component, while assessment of Level II subjects is carried out by the student's school. Standardisation and comparability studies of assessment procedures are supervised by the School Board.

## Subjects

HSC science subjects are: Biology, Chemistry, Geology, Environmental Studies and Physics.

HSC mathematics subjects are. Algebra and Geometry, Analysis and Statistics, Computer Studies and Mathematics.

# SOUTH AUSTRALIA

## Background

Since the mid 1960's there have been considerable changes to science and mathematics courses and accreditation and assessment procedures. Biology was introduced as a matriculation subject in 1966, based on the Australian adaptation of the Biological Science Curriculum Study. Since its introduction, the Biology course has been changing constantly in various ways. For example, major changes to the option component of the course were made in 1974 in an attempt to produce a less rigid course.

The Chemistry course was considerably revitalised in the late 1970's, and a new syllabus was introduced in 1981 aimed at decreasing conceptual content and increasing the students' knowledge and perception of chemistry as a practical course.

The Physics and Geology courses have been Year 12 tertiary entrance courses since the mid-1960's and have undergone revision to meet the demands of students proceeding to both tertiary studies and to related fields for which subject matter is either a specific prerequisite or a desirable preliminary.

At all levels of compulsory education in South Australia, students are expected to study a course in mathematics. The Mathematics 1S syllabus was developed and first examined in 1972 to meet the needs of students intending to pursue studies in the second group of tertiary courses. The current syllabi for Mathematics

1S, 1 and 2 are the result of continuing consultation between representatives of secondary schools and tertiary institutions. These syllabi are suitable for a progression from secondary to tertiary studies in or involving mathematics, as well as being a culminating secondary school mathematics subject.

In the current structuring of these three subjects, Mathematics 1S is a subset of Mathematics 1 and Mathematics 2. Consequently, it is not appropriate for students to take Mathematics 1S in combination with Mathematics 1 and/or Mathematics 2 in the same year. Students taking one Mathematics subject would normally take Mathematics 1S. Students taking two mathematics subjects must take Mathematics 1 and Mathematics 2. Three mathematics subjects may not be studied concurrently in the same year.

### Course of Study and Certification

In Year 11 all subjects are school-based and assessed. However, subjects taken and assessed in Year 12 lead to the award of the Senior Certificate of Achievement. Subject availability, syllabi, accreditation, assessment procedures and public examinations are controlled and monitored by the Senior Secondary Assessment Board of South Australia (SSABSA).

### Subject Levels

There are two levels of Year 12 subjects. For entry requirements to tertiary institutions, students take Public Examination subjects; however, for specific courses at the Colleges of Advanced Education, School assessed subjects are also acceptable.

### Subjects

Publicly examined science subjects are: Biology, Chemistry, Physics, Geology.
Publicly examined mathematics subjects are: Mathematics 1, Mathematics 2, Mathematics 1S.

## WESTERN AUSTRALIA

### Background

Prior to 1965, the Public Examinations Board in Western Australia conducted the Leaving Certificate Examinations at the conclusion of Year 12 following two years of study. Four science subjects were originally available - Biology, Chemistry, Geology and Physics. In 1970 a fifth subject was introduced, namely Human Biology, which has enjoyed an increasing popularity since its introduction. The only other change in science subjects occurred in 1979 with the introduction of Physical Science which has been a successful addition to the subject offerings.

Two mathematics subjects were available until 1965 - Mathematics A which dealt with algebra, geometry and trigonometry, and Mathematics B which included the study of calculus in addition to the other topics. The latter unit was regarded as the more advanced of the two and both were pre-requisites for most of the mathematics and science-oriented courses at tertiary level. Another unit, General Mathematics, was introduced by the Board in 1965. It was designed as a terminal unit for students who either wished to curtail their mathematical studies at Year 12, or who wished to study biological sciences at tertiary level. By 1970 this unit had been renamed Mathematics I while Mathematics A and B were renamed Mathematics II and III respectively.

Despite the dual aims of Mathematics I, it soon became apparent that it was not fulfilling its purpose as far as a terminal unit was concerned; consequently a further unit, Mathematics IV was introduced in 1974.

Mathematics II and III are usually studied concurrently and lead to tertiary studies in which mathematics plays an integral part. Mathematics I provides a satisfactory background for tertiary studies in which the mathematics content is minimal, whilst Mathematics IV is not designed to provide a foundation for any future tertiary studies involving mathematics. The Public Examination Board was replaced by the Board of Secondary Education in 1975, and this body conducted the examinations at the end of Year 12 until it was replaced by the Secondary Education Authority (SEA) in 1985. From 1986, the SEA becomes responsible for the Tertiary Entrance Examinations (TEE).

### Course of Study and Certification

Two separate courses of study are available for students in their final years of secondary schooling. The Secondary Education Authority now approves courses of study and awards a Certificate of Secondary Education (CSE). The Authority has also assumed the responsibilities of the Tertiary Institutions Service Centre (TISC) which has, between 1975-1985, conducted Tertiary Admissions Examinations (TAE) within a policy established by a committee composed of representatives of government and non-government schools, the Education

Department and the State's various tertiary institutions. The institutions will use the TEE results for admission purposes from 1986.

### Subject Levels

There are two levels of subjects - CSE and TAE. CSE subjects are school-based and are assessed for the award of the Certificate of Secondary Education. For the CSE, moderated school assessments and the results of examinations or moderating tests are combined to assess the efforts of students attending approved schools. Typically, the subjects studied are designed to satisfy the requirements of students who do not propose to proceed with tertiary studies.

TAE subjects are externally examined and are intended for students seeking admission to a tertiary institution. TAE students are awarded an aggregate score (maximum 500) based on the student's best 5 subjects. The aggregate required for entry varies from one institution to another.

### Subjects

TAE science subjects are: Biology, Human Biology, Chemistry, Physics, Geology, Physical Science.
TAE mathematics subjects are: Mathematics I, II, III and IV.

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CHAPTER 2

# ENROLMENT STATISTICS

## 2.1 INTRODUCTION

### Science

The Dainton Report (Council for Scientific Policy, 1968), heralded the 'swing' away from science in the United Kingdom in the 1960's. The Report pointed out that this trend could have disastrous effects on the technological future of the country if allowed to continue, and suggested that changes should be made in school curricula to counteract the declining interest in science amongst young people . A similar phenomena has been observed in Australia. Dow (1971) surveyed Australian secondary school science enrolment patterns over the period 1960 to 1969. He concluded that the proportion of students taking chemistry and physics with respect to the total pool of available students at matriculation level was decreasing in all States. However, this decline was more than outweighed by the proportion of students taking biology.

Duckworth (1979) challenged the Dainton Report's interpretation of the reason for the 'swing' away from science based on an analysis of the composition of the 6th Form in the United Kingdom. His analysis revealed that the composition of the 6th Form had changed significantly during the 1960's. Not only had the proportion of the age cohort staying on to the 6th Form increased, but there was also a significant increase in the proportion of females who tended not to study science subjects. Duckworth (1979) was able to show that the 'swing' was not against science per se, but away from a range of subjects which require cumulative learning and were therefore perceived by the students as being difficult and demanding.

### Mathematics

A somewhat similar phenomenon of enrolment change has been evident in secondary school mathematics. Over the past decade, a number of State, national and international reports (e.g. STEP, 1980; Fey, 1981a, 1981b; NACOME, 1981) concerned with mathematics achievement, course trends and instructional patterns, have produced a wealth of information, much of which is mutually confirmatory even when considered in the light of obvious national or cross-cultural differences among the various samples surveyed. The apparent "swing" away from traditional or more rigorous mathematics courses, evident among high school students in the United Kingdom and the USA during the 1970's, parallels the situation in science and is one issue which has attracted universal attention. The Cockcroft Report (Shuard, 1982) confirms such findings in the United Kingdom, as does the National Assessment of Educational Progress Report (Fey, 1981b) in the U.S.A. Concerning Australia, an analysis of the participation patterns of secondary mathematics students conducted by the Queensland Board of Teacher Education (1985) using three major data sources - two State (STEP, 1980; Queensland Board of Teacher Education, 1985), and one National study (Dekkers et al 1982, 1983) - suggested that mathematics enrolments continue at a high level, boosted by a "swing" away from the more traditional mathematics courses to the less rigorous ones.

It is important to update and examine the existing mathematics and science enrolment data, for a quiet 'revolution' has been underway in Australian secondary schools over the last decade, and it behoves all interested parties to gain an understanding of this phenomenon.

## 2.2 NATIONAL SCHOOL ENROLMENTS

The basic information on male and female retentivities in Australian secondary schools since 1970 is shown in Table 1. The retentivity is determined by comparing the number of Peer-Year-12 students in any one particular year to the Parent-Year-8 population four years earlier. The data apply to all States and the Australian Capital Territory, and have been obtained from the Australian Bureau of Statistics.

The data in Table 1 indicate that the female Parent-Year-8 population is less than the corresponding male Parent-Year-8 population for each year from 1966-1985. This was also the case for the Peer-Year-12 population until 1977 when, for the first time, the number of females in Year 12 exceeded the number of males. This change is also reflected in the retentivities Whilst the male retentivity did not change significantly from 1970-1982, the female retentivity has shown a steady increase since 1970, and since 1976 has exceeded the male retentivity. This dramatic increase in female retentivity (of 89% over the past 16 years) has been the single most important factor in changing school enrolments during this period of time. However, it is significant that since 1982 the male retentivity has increased by approximately 30%.

In terms of total retentivity, the value reached 46% in 1985 and it seems inevitable that at least half of the age cohort will complete Year 12 of secondary schooling in the near future.

The national trends for students enrolled in Year 8 from 1966-1985 are shown in Figure 1. After a steady growth from 1966 to 1975 the number of students declined, but since 1980 there has been an increase, the rate of which has exceeded the steady growth in the late 1960's and early 1970's.

## TABLE 1

**School Enrolments in Australia, 1970-1985**

| Year | Parent-Year-8 Population Male | Parent-Year-8 Population Female | Peer-Year-12 Population Male | Peer-Year-12 Population Female | Retentivity Male | Retentivity Female | Total |
|---|---|---|---|---|---|---|---|
| 1966 | 111184 | 106112 | — | — | — | — | — |
| 1967 | 111593 | 107297 | — | — | — | — | — |
| 1968 | 115229 | 109471 | — | — | — | — | — |
| 1969 | 117445 | 112010 | — | — | — | — | — |
| 1970 | 119852 | 113929 | 37597 | 27681 | 33.8 | 26.1 | 30.0 |
| 1971 | 122107 | 116136 | 38968 | 29357 | 34.9 | 27.4 | 31.2 |
| 1972 | 124604 | 119197 | 41758 | 32119 | 36.2 | 29.3 | 32.9 |
| 1973 | 126740 | 121099 | 41828 | 34854 | 35.6 | 31.1 | 33.4 |
| 1974 | 130809 | 124481 | 41129 | 36277 | 34.3 | 31.8 | 33.1 |
| 1975 | 132387 | 125984 | 42556 | 39313 | 34.9 | 33.9 | 34.4 |
| 1976 | 130948 | 124217 | 43657 | 42421 | 35.0 | 35.6 | 35.3 |
| 1977 | 127411 | 121306 | 43390 | 44748 | 34.2 | 37.0 | 35.6 |
| 1978 | 124883 | 118963 | 43531 | 46692 | 33.3 | 37.5 | 35.3 |
| 1979 | 124975 | 118886 | 43081 | 47007 | 32.5 | 37.3 | 34.9 |
| 1980 | 125458 | 120444 | 42221 | 46817 | 32.2 | 37.7 | 34.9 |
| 1981 | 128437 | 122699 | 41550 | 46779 | 32.6 | 38.6 | 35.5 |
| 1982 | 134172 | 128984 | 41704 | 47941 | 33.4 | 40.3 | 36.8 |
| 1983 | 137029 | 130594 | 46697 | 51991 | 37.4 | 43.7 | 40.6 |
| 1984 | 142935 | 137495 | 52728 | 57766 | 42.0 | 48.0 | 45.0 |
| 1985 | 142200 | 136173 | 55713 | 60603 | 43.4 | 49.4 | 46.3 |

The national enrolment trends for students in Year 12 over the period 1976-1985 are shown in Figure 2. Over the period 1976-1982 the numbers were approximately constant, since the greater retentivity of females was balanced by the declining retentivity of males. However, from 1983 to 1985 there has been a dramatic growth, reflecting the enhanced male and female retentivity over these three years.

Since the Parent-Year-8 population is four years ahead of the corresponding Peer-Year-12 population, it is apparent that the growth in the former from 1981-1985 will 'flow on' to Year 12 from 1985-1989. The larger age cohort, coupled with the trends in retentivity described above, should have a significant impact on the number of students entering Year 12 in the immediate future, and presumably on the number of students wishing to enter tertiary institutions a year later.

The remainder of this Chapter presents details of science and mathematics subject enrolments for each State. It is to be noted that:—

- The data are presented for male and female students taking science and mathematics as public examination subjects at the end of Year 12. The exception is Queensland where students do not sit for a public examination but are awarded ratings based on moderated school assessments during Years 11 and 12.
- The data include students from both Government and non-Government schools.
- The data represent the total number of student enrolments in science and mathematics subjects. Thus, where students take a combination of mathematics subjects, the total mathematics enrolment will be higher than the actual number of mathematics students.
- The data include the number of students in the Parent-Year-8 population from 1966-1985 and those in the Peer-Year-12 population from 1970-1985. This manner of presentation enables the retentivity for each State to be determined. It also enables the proportion of students studying each subject to be calculated with respect to the Year 12 base year and also to the Year 8 base year respectively.

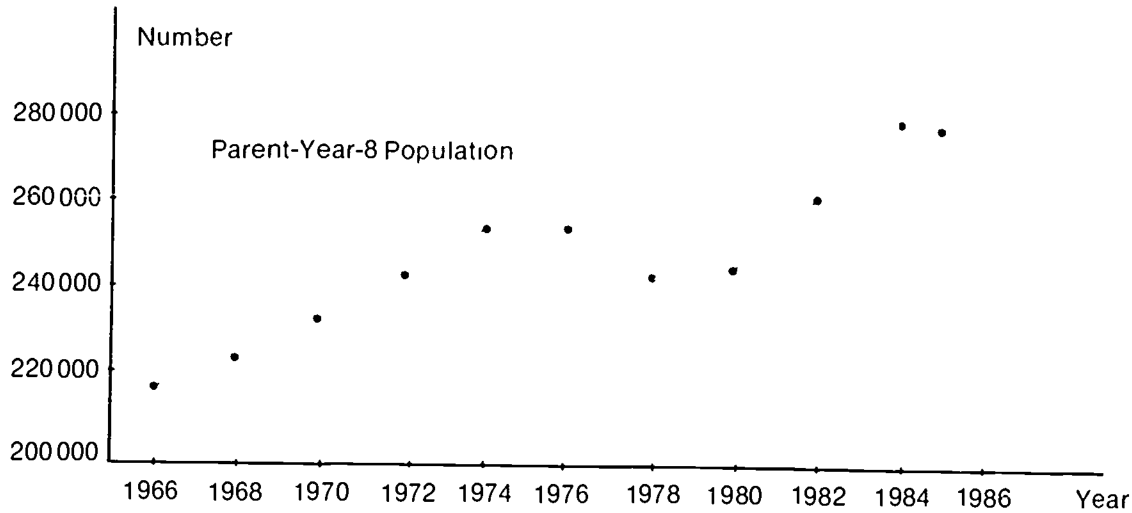


Figure 1 National trends for students entering the first year of Secondary Education (Parent-Year-8) from 1966-1985

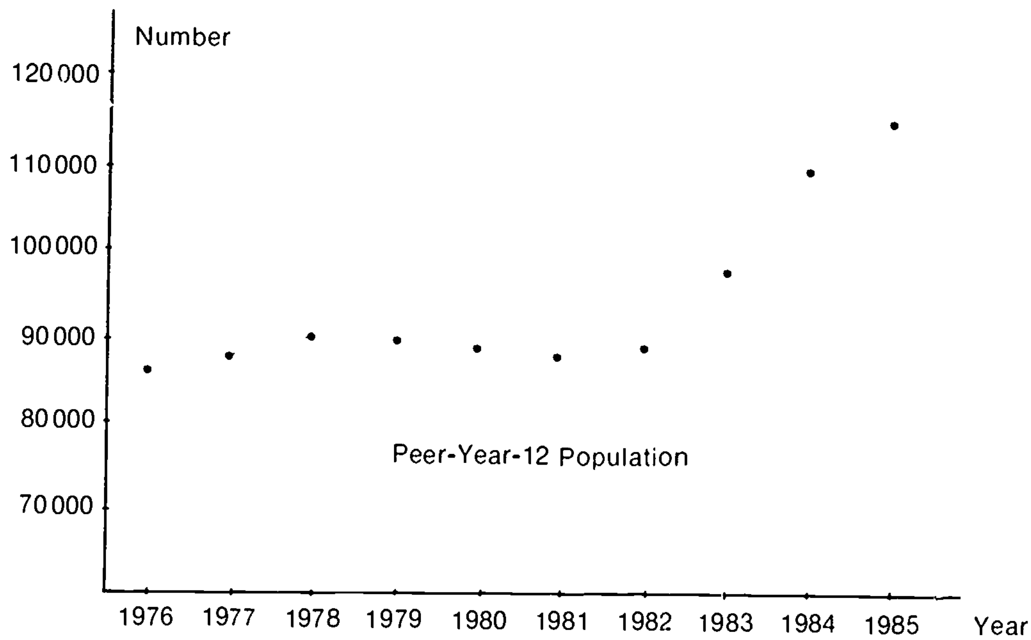


Figure 2 National trends for students in the final year of Secondary Education (Peer-Year-12) from 1976-1985

2.

## 2.3 SCIENCE

### Biology Enrolment Statistics

Male/female biology enrolments and their respective Parent-Year-8 and Peer-Year-12 population for each State are presented in Table 2. The proportions of biology students with respect to the Year 12 and Year 8 base years are also presented.

The variation of biology Year 12 enrolments over the time period 1976-1985 are shown in Figure 3. The enrolments show a sinusoidal trend with steady increases in the late 1970's being followed by a decline in the early 1980's until in 1982 the total biology enrolments were less than in 1976 However from 1983 to 1985 there has been a dramatic growth so that in 1985 the total biology enrolments reached a maximum of 52,959.

**TABLE 2:**

**Biology Enrolment Statistics in Australia**

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Biology Enrolments Male | Year 12 Biology Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| QUEENSLAND | | | | | | | | |
| 1966 | 32021 | | | | | | | |
| 1967 | 32242 | | | | | | | |
| 1968 | 33127 | | | | | | | |
| 1969 | 34043 | | | | | | | |
| 1970 | 34679 | 9407 | 29 4 | | | 3089 | 1 000 | 1.000 |
| 1971 | 35355 | 9883 | 30.7 | | | 3492 | 1 076 | 1.123 |
| 1972 | 36999 | 10770 | 32.5 | | | 4556 | 1.288 | 1 426 |
| 1973 | 37742 | 10973 | 32.2 | 2160 | 2773 | 4933 | 1 378 | 1.512 |
| 1974 | 39595 | 11368 | 32.8 | 2473 | 3420 | 5893 | 1.580 | 1.763 |
| 1975 | 39805 | 11586 | 32.8 | 2725 | 3849 | 6574 | 1.728 | 1.928 |
| 1976 | 39493 | 12920 | 34 9 | 3237 | 4393 | 7630 | 1.798 | 2.138 |
| 1977 | 38780 | 13871 | 36.8 | 3575 | 4907 | 8482 | 1 862 | 2.330 |
| 1978 | 37962 | 14818 | 37.1 | 3836 | 5460 | 9296 | 1.913 | 2 437 |
| 1979 | 37696 | 14995 | 37.7 | 3797 | 5790 | 9587 | 1.947 | 2.497 |
| 1980 | 39319 | 15251 | 38.6 | 3652 | 5640 | 9292 | 1.855 | 2.439 |
| 1981 | 41149 | 15016 | 38.7 | 3393 | 5449 | 8842 | 1.793 | 2.364 |
| 1982 | 43800 | 15996 | 42.1 | 3678 | 5740 | 9418 | 1 793 | 2 572 |
| 1983 | 45672 | 17810 | 47 2 | 3919 | 6166 | 10085 | 1.724 | 2 773 |
| 1984 | 48007 | 20865 | 53.1 | 4617 | 6939 | 11556 | 1.687 | 3.047 |
| 1985 | 47338 | 22668 | 55.1 | 4942 | 7209 | 12151 | 1.632 | 3.061 |
| NEW SOUTH WALES | | | | | | | | |
| 1966 | 75233 | | | | | | | |
| 1967 | 76421 | | | | | | | |
| 1968 | 77983 | | | | | | | |
| 1969 | 79161 | | | | | | | |
| 1970 | 80421 | 23805 | 31 6 | | | | | |
| 1971 | 82712 | 24822 | 32.5 | | | | | |
| 1972 | 83534 | 26564 | 34 1 | | | | | |
| 1973 | 84807 | 27061 | 34 2 | | | | | |
| 1974 | 86619 | 26837 | 33 4 | | | | | |
| 1975 | 88735 | 28014 | 33.9 | | | | | |
| 1976 | 87605 | 29222 | 35.0 | 6000 | 9067 | 15067 | 1.000 | 1.000 |
| 1977 | 86289 | 30652 | 36 1 | 5985 | 9465 | 15450 | 0 978 | 0 985 |
| 1978 | 83230 | 31276 | 36.1 | 5897 | 9992 | 15889 | 0.985 | 1.017 |
| 1979 | 81995 | 30927 | 34.9 | 5233 | 9867 | 15100 | 0.947 | 0.943 |
| 1980 | 81891 | 28881 | 33.0 | 4698 | 9168 | 13866 | 0 931 | 0 878 |
| 1981 | 82439 | 28411 | 32.9 | 4433 | 8843 | 13276 | 0 906 | 0.853 |
| 1982 | 85509 | 28075 | 33.7 | 4050 | 8737 | 12787 | 0.883 | 0.852 |
| 1983 | 86881 | 30712 | 37.5 | 4222 | 8981 | 13203 | 0.833 | 0.892 |
| 1984 | 92284 | 33784 | 41 3 | 4779 | 9336 | 14115 | 0.810 | 0 956 |
| 1985 | 94397 | 34261 | 41.6 | 4606 | 9065 | 13671 | 0.774 | 0 919 |

## Table 2: (contd)

### Biology Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Biology Enrolments Male | Year 12 Biology Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| AUSTRALIAN CAPITAL TERRITORY | | | | | | | | |
| 1973 | 3211 | | | | | | | |
| 1974 | 3469 | | | | | | | |
| 1975 | 3824 | | | | | | | |
| 1976 | 3877 | | | | | | | |
| 1977 | 3978 | 2136 | 66 5 | 340 | 533 | 873 | 1.000 | 1.000 |
| 1978 | 3858 | 2317 | 66.8 | 340 | 564 | 904 | 0 955 | 0.958 |
| 1979 | 4002 | 2578 | 67 4 | 366 | 726 | 1092 | 1.036 | 1 050 |
| 1980 | 3976 | 2538 | 65 5 | 305 | 657 | 962 | 0 927 | 0.913 |
| 1981 | 4056 | 2675 | 67.2 | 307 | 681 | 988 | 0.903 | 0.913 |
| 1982 | 4248 | 2720 | 70.5 | 306 | 635 | 941 | 0.846 | 0 897 |
| 1983 | 4651 | 2918 | 72 9 | 283 | 631 | 914 | 0.766 | 0 840 |
| 1984 | 5065 | 3145 | 79 1 | 303 | 635 | 938 | 0.730 | 0.868 |
| 1985 | 5107 | 3150 | 77.7 | 320 | 645 | 965 | 0 750 | 0.875 |
| VICTORIA | | | | | | | | |
| 1966 | 60154 | | | | | | | |
| 1967 | 59858 | | | | | | | |
| 1968 | 61490 | | | | | | | |
| 1969 | 62762 | | | | | | | |
| 1970 | 63801 | 18915 | 31.4 | 1891 | 4151 | 6042 | 1 000 | 1.000 |
| 1971 | 65185 | 19221 | 32.1 | 2108 | 4581 | 6689 | 1.089 | 1.113 |
| 1972 | 66983 | 20367 | 33.1 | 2363 | 4939 | 7302 | 1.122 | 1.182 |
| 1973 | 67267 | 21416 | 34.1 | 2781 | 5739 | 8520 | 1 245 | 1.352 |
| 1974 | 69520 | 21465 | 33.6 | 2787 | 5963 | 8750 | 1.276 | 1.365 |
| 1975 | 69672 | 22930 | 35.2 | 3138 | 6507 | 9645 | 1.317 | 1.473 |
| 1976 | 69052 | 23580 | 35.2 | 3338 | 6898 | 11236 | 1 359 | 1 522 |
| 1977 | 68034 | 22884 | 34 0 | 3281 | 6966 | 10247 | 1.402 | 1.517 |
| 1978 | 66932 | 23046 | 33.1 | 3339 | 7403 | 10742 | 1.459 | 1.538 |
| 1979 | 65684 | 22528 | 32.3 | 3169 | 7030 | 10199 | 1 417 | 1.457 |
| 1980 | 67019 | 22580 | 32 7 | 3080 | 7124 | 10204 | 1.415 | 1 471 |
| 1981 | 67866 | 22573 | 33 2 | 2940 | 6855 | 9795 | 1.358 | 1.433 |
| 1982 | 71461 | 23050 | 34.4 | 2647 | 6617 | 9264 | 1.258 | 1.378 |
| 1983 | 71048 | 25385 | 38.7 | 2737 | 7023 | 9760 | 1 203 | 1 479 |
| 1984 | 74594 | 28971 | 43.2 | 3163 | 7438 | 10601 | 1.081 | 1.555 |
| TASMANIA | | | | | | | | |
| 1966 | 7890 | | | | | | | |
| 1967 | 7746 | | | | | | | |
| 1968 | 7762 | | | | | | | |
| 1969 | 8352 | | | | | | | |
| 1970 | 8162 | 1358 | 17 2 | | | 1233 | 1.000 | 1.000 |
| 1971 | 8112 | 1581 | 20.4 | | | 1553 | 1.082 | 1.283 |
| 1972 | 8148 | 1787 | 23 0 | 800 | 846 | 1646 | 1.014 | 1 357 |
| 1973 | 8205 | 1966 | 23.5 | 829 | 928 | 1757 | 0 984 | 1.346 |
| 1974 | 8532 | 1864 | 22 8 | 601 | 750 | 1351 | 0 798 | 1.059 |
| 1975 | 8555 | 2086 | 25 7 | 671 | 800 | 1471 | 0.777 | 1 160 |
| 1976 | 8228 | 2079 | 25.5 | 586 | 740 | 1326 | 0.702 | 1.041 |
| 1977 | 8238 | 3113 | 25 8 | 549 | 771 | 1320 | 0.688 | 1.029 |
| 1978 | 7797 | 2099 | 24 6 | 512 | 799 | 1311 | 0.688 | 0.983 |
| 1979 | 7409 | 2215 | 25.9 | 800 | 1520 | 2320 | 1 154 | 1.735 |
| 1980 | 7344 | 2237 | 27 2 | 671 | 1286 | 1957 | 0 963 | 1.522 |
| 1981 | 7358 | 2203 | 26.7 | 605 | 1157 | 1762 | 0 881 | 1.369 |
| 1982 | 7914 | 1716 | 22.0 | 571 | 969 | 1540 | 0.988 | 1.264 |
| 1983 | 7939 | 1845 | 24 9 | 558 | 1056 | 1614 | 0.963 | 1.394 |
| 1984 | 8212 | 2033 | 27.7 | 533 | 996 | 1529 | 0.828 | 1.332 |
| 1985 | 8072 | 2126 | 28.9 | 567 | 1036 | 1603 | 0 830 | 1.394 |

## Table 2: (contd)

### Biology Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Biology Enrolments Male | Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| SOUTH AUSTRALIA | | | | | | | | |
| 1966 | 22566 | | | | | | | |
| 1967 | 22965 | | | | | | | |
| 1968 | 23081 | | | | | | | |
| 1969 | 23448 | | | | | | | |
| 1970 | 23911 | 5972 | 26 5 | | | 2857 | 1.000 | 1.000 |
| 1971 | 24040 | 6836 | 29.8 | | | 3712 | 1.135 | 1.277 |
| 1972 | 24545 | 7468 | 32.4 | | | 4[illegible]32 | 1.269 | 1.551 |
| 1973 | 25418 | 7730 | 33 0 | 2264 | 2828 | 5092 | 1.377 | 1 715 |
| 1974 | 25527 | 7758 | 32 4 | 2387 | 3140 | 5527 | 1.489 | 1.826 |
| 1975 | 25366 | 8670 | 36.1 | 2644 | 3607 | 6251 | 1 507 | 2 054 |
| 1976 | 24592 | 9093 | 37 0 | 2524 | 3764 | 6288 | 1.445 | 2 023 |
| 1977 | 23902 | 9066 | 35 7 | 2271 | 3710 | 5981 | 1.379 | 1 859 |
| 1978 | 23364 | 9124 | 35.7 | 2096 | 3608 | 5704 | 1.307 | 1.765 |
| 1979 | 22390 | 9356 | 36.9 | 1949 | 3457 | 5406 | 1.208 | 1.683 |
| 1980 | 22115 | 9535 | 38 8 | 1872 | 3188 | 5060 | 1 109 | 1 625 |
| 1981 | 22893 | 9308 | 38.9 | 1540 | 3046 | 4586 | 1.030 | 1.515 |
| 1982 | 23695 | 9580 | 41.0 | 1449 | 3006 | 4455 | 0.972 | 1.506 |
| 1983 | 23851 | 10653 | 47.6 | 1615 | 3097 | 4712 | 0.925 | 1.662 |
| 1984 | 23483 | 11087 | 50.1 | 1583 | 3217 | 4790 | 0.903 | 1.711 |
| 1985 | 22658 | 11711 | 51.2 | 1589 | 3146 | 4735 | 0 845 | 1 634 |
| WESTERN AUSTRALIA | | | | | | | | |
| 1966 | 17411 | | | | | | | |
| 1967 | 17637 | | | | | | | |
| 1968 | 19059 | | | | | | | |
| 1969 | 19333 | | | | | | | |
| 1970 | 20064 | 4680 | 26.9 | 960 | 1784 | 2744 | 1 000 | 1.000 |
| 1971 | 20145 | 4866 | 27 6 | 1127 | 1927 | 3054 | 1.070 | 1.099 |
| 1972 | 20642 | 5648 | 29.6 | 1477 | 2448 | 3925 | 1 185 | 1 307 |
| 1973 | 21202 | 6121 | 31.7 | 1840 | 3101 | 4941 | 1.377 | 1.622 |
| 1974 | 22028 | 6581 | 32.8 | 2024 | 3366 | 5390 | 1.397 | 1.705 |
| 1975 | 22414 | 6870 | 34.1 | 2193 | 4014 | 6207 | 1.541 | 1 955 |
| 1976 | 22665 | 7380 | 35 7 | 2656 | 4530 | 7186 | 1.661 | 2 209 |
| 1977 | 22371 | 7416 | 35 0 | 2494 | 4875 | 7369 | 1.695 | 2.205 |
| 1978 | 21861 | 7543 | 34 [illegible] | 2386 | 5026 | 7412 | 1 676 | 2.135 |
| 1979 | 22198 | 7631 | 34.0 | 2346 | 4984 | 7330 | 1.638 | 2.075 |
| 1980 | 22110 | 7700 | 34.0 | 2422 | 5102 | 7524 | 1.667 | 2.107 |
| 1981 | 23262 | 7843 | 35 1 | 2243 | 5045 | 7288 | 1 585 | 2.067 |
| 1982 | 24213 | 8184 | 37 4 | 2165 | 4644 | 6809 | 1.419 | 1 976 |
| 1983 | 25914 | 8970 | 40.4 | 2402 | 4997 | 7399 | 1 407 | 2.115 |
| 1984 | 26126 | 10090 | 45.6 | 2809 | 5570 | 8379 | 1.416 | 2 405 |
| 1985 | 25138 | 11059 | 47.5 | 3211 | 6022 | 9233 | 1.424 | 2 518 |

* Peer-Year-12 Proportion in 198X =

$$\frac{\text{Year 12 Biology Enrolment in 198X}}{\text{Year 12 Biology Enrolment in base year}} \times \frac{\text{Peer Year 12 Population in base year}}{\text{Peer Year 12 Population 198X}}$$

** Parent-Year-8 Proportion 198X =

$$\frac{\text{Year 12 Biology Enrolment in 198X}}{\text{Year 12 Biology Enrolment in base year}} \times \frac{\text{Parent Year 8 Population in base year}}{\text{Parent Year 8 Population 198(X-4)}}$$

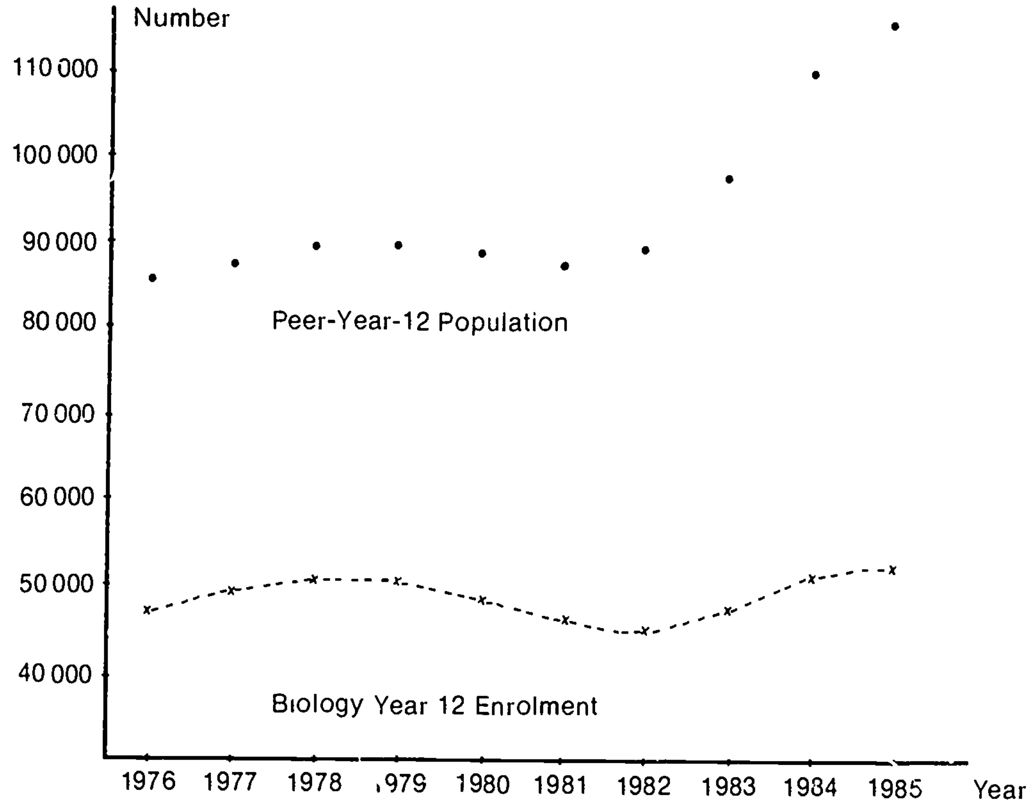


Figure 3 National trends for students taking Biology as a Public Examinations subject as compared to the Peer-Year-12 population over the period 1976-1985

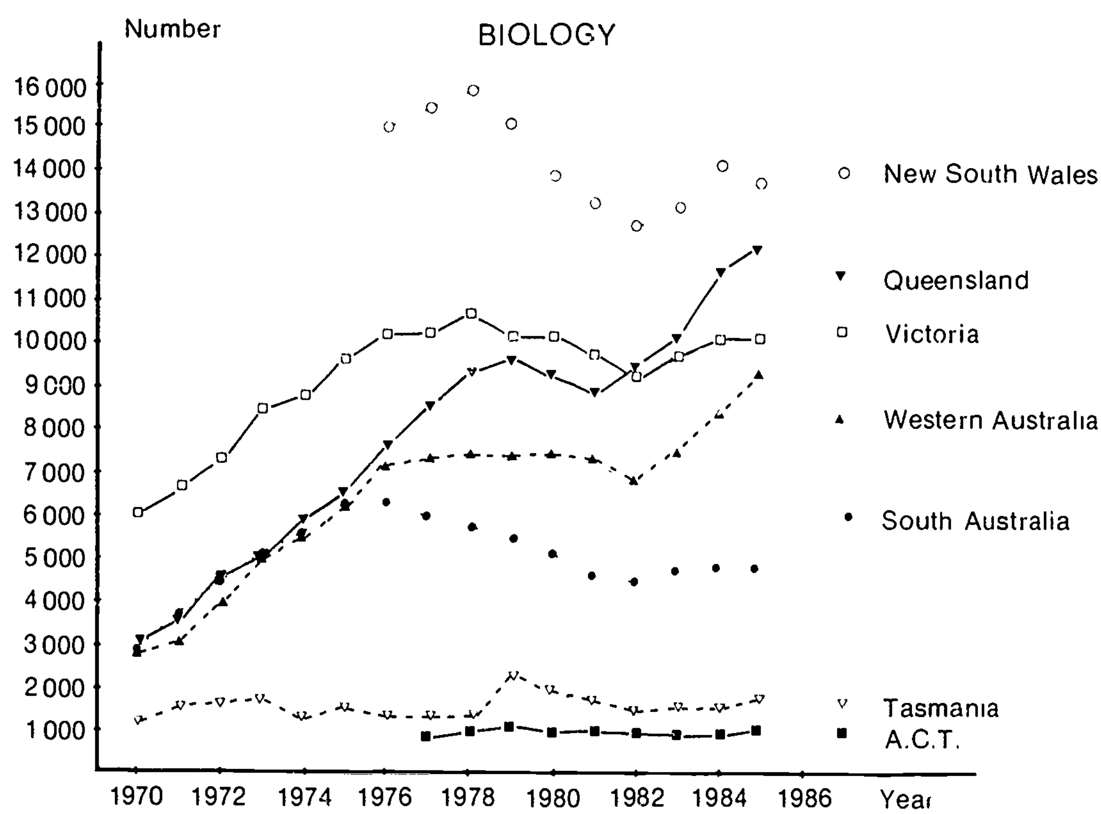


Figure 4 The number of students taking Biology as a Public Examinations subject from 1970-1985 (Victoria, Queensland, South Australia, Western Australia and Tasmania), from 1976-1985 (New South Wales), and from 1977-1985 (ACT)

Figure 4 depicts the statistical data in Table 2 in schematic form on a State-by-State basis. Queensland has shown the greatest increase in student numbers over the 1970-1985 period, from 3,089 in 1970 to 12,151 in 1985, so that Queensland now has the largest enrolment in biology except for New South Wales. Since 1973 there has been an ever-increasing difference between male and female enrolments and in 1985, 46% more females than males were enrolled in biology. The proportion of students studying biology with respect to the 1970 base year has exceeded unity for both Peer-Year-12 and Parent-Year-8 enrolments for every year since 1970. In 1985 the proportion of the Parent-Year-8 population with respect to 1970 exceeds 300%.

New South Wales has the largest number of students studying biology, but the data are only listed since 1976 because in that year the pattern of secondary education changed in that State. The biology enrolments in Table 2 represent actual biology enrolments in 4 unit and 2 unit courses. After reaching a maximum of 15,889 students in 1978 the NSW numbers declined significantly to a low of 12,787 in 1982, but in 1983 the downward trend stabilised and in 1985 the number of biology enrolments reached 13,671. The overall decrease in student numbers has been caused almost entirely by the decline in male enrolments.

The statistics for the Australian Capital Territory require some explanation. Prior to 1977 students from the ACT took the NSW Higher School Certificate, but it proved impossible to extract the ACT data from the total NSW figures. However the data for the ACT from 1977-1985 are listed in Table 2 and displayed in Figure 4. The data show a constant trend with a small decline in male enrolments being offset by a slightly larger increase in female enrolments. The proportion of biology enrolments to the Parent-Year-8 and Peer-Year-12 populations with respect to the 1977 base year is less than unity for every year except 1979. In 1983 three biology subjects were introduced in the ACT namely General Biology, Human Biology and Web of Life Biology. The data in Table 2 for 1983 to 1985 are a composite of these three biological science subjects.

The Victorian enrolments showed significant increases from 1970 to 1976 but thereafter the enrolments have remained approximately constant, although there was a decline in enrolments in the early 1980's. The proportion of students studying biology with respect to the 1970 base year has exceeded unity for both Year 12 and Year 8 enrolments for every year since 1970. The enrolments are dominated by females, with approximately 2.25 times more females being enrolled in the 1970-1985 period than males.

The Tasmanian enrolments have been relatively constant over the 16-year period, although there was a dramatic increase in 1979 which was due to the introduction of new Higher School Certificate subjects. However the numbers then declined as the 'old' subjects were phased out, so that the numbers in the last few years are essentially the same as in the early 1970's. A decline in male enrolments over the 1970-1985 period has been counter-balanced by an increase in female enrolments. However the proportion of students studying biology with respect to the Peer-Year-12 population compared to the 1970 base year has been less than unity for most of the period from 1970-1985, although the corresponding proportion with respect to the Parent-Year-8 population is greater than unity.

The South Australian enrolment figures show a rapid increase from 1970 to 1975 which paralleled the situation in Queensland and Western Australia. However, after 1976 the numbers gradually declined to a low point of 4,455 students in 1982, but have since shown an increase. The proportion of students studying biology compared to the Peer-Year-12 population declined to less than unity in 1982 with respect to the 1970 base year, although with respect to the Parent-Year-8 population the value still exceeds unity. The decline in student numbers since the mid-1970's has been largely caused by a drop in male enrolments - from a maximum of 2,644 in 1975 to a minimum of 1,449 in 1982. Female enrolments have also declined from 1976, but not to the same extent as the male enrolments.

Western Australian enrolments have shown a massive increase over the 1970-1985 period, most of the increase occurring in the 1970-1976 and the 1982-1985 periods. The increase in enrolments has been evenly distributed between males and females The proportion of students studying biology with respect to the 1970 base year has exceeded unity for both Peer-Year-12 and Parent-Year-8 enrolments for every year since 1970 and the 1985 Parent-Year-8 proportion is approximately 2.5 times the 1970 value

## TABLE 3:

**Biology and human biology enrolment statistics in Western Australia**

| Year | Biology Male | Biology Female | Biology Total | Human Biology Male | Human Biology Female | Human Biology Total |
|---|---|---|---|---|---|---|
| 1970 | 931 | 1635 | 2566 | 29 | 149 | 178 |
| 1971 | 1092 | 1721 | 2813 | 35 | 206 | 241 |
| 1972 | 1392 | 2014 | 34[illegible] | 85 | 434 | 519 |
| 1973 | 1620 | 2324 | 3944 | 220 | 777 | 997 |
| 1974 | 1693 | 2390 | 4083 | 331 | 976 | 1307 |
| 1975 | 17[illegible]8 | 2681 | 4419 | 455 | 1333 | 1788 |
| 1976 | 1974 | 2704 | 4678 | 682 | 1826 | 2508 |
| 1977 | 1757 | 2733 | 4490 | 737 | 2142 | 2879 |
| 1978 | 1722 | 2904 | 4626 | 664 | 2122 | 2786 |
| 1979 | 1690 | 2890 | 4580 | 656 | 2094 | 2750 |
| 1980 | 1789 | 2860 | 4649 | 633 | 2242 | 2875 |
| 1981 | 1553 | 2500 | 4053 | 690 | 2545 | 3235 |
| 1982 | 1447 | 2213 | 3660 | 718 | 2431 | 3149 |
| 1983 | 1574 | 22[illegible]7 | 3821 | 828 | 2750 | 3578 |
| 1984 | 1734 | 2383 | 4117 | 1075 | 3187 | 4262 |
| 1985 | 1882 | 2536 | 4418 | 1329 | 3486 | 4815 |

It should be noted that in Western Australia, two Public Examination subjects - Biology and Human Biology - are included in the statistics in Table 2. The enrolments for these two subjects are presented in Table 3 and shown in Figure 5. Although both subjects have been offered over the period 1970-1985, Human Biology had a very small enrolment in the early 1970's, but has now increased in popularity to the stage where the Human Biology numbers have exceeded the Biology enrolments in 1984 and 1985.

Human Biology has been particularly popular with females, with approximately three times as many females as males taking this subject. The enrolments in Human Biology have increased consistently throughout the period covered by this monograph, whilst the numbers in Biology reached a maximum in 1976. Male and female enrolments in Biology are much more evenly balanced than is the case for Human Biology, where approximately 72% of the 1985 enrolments are females. Undoubtedly the presence of Human Biology in Western Australia has been the major reason for the dramatic increase in Biology enrolments that has occurred in the 1970-1985 period as depicted in Table 2 and Figure 4

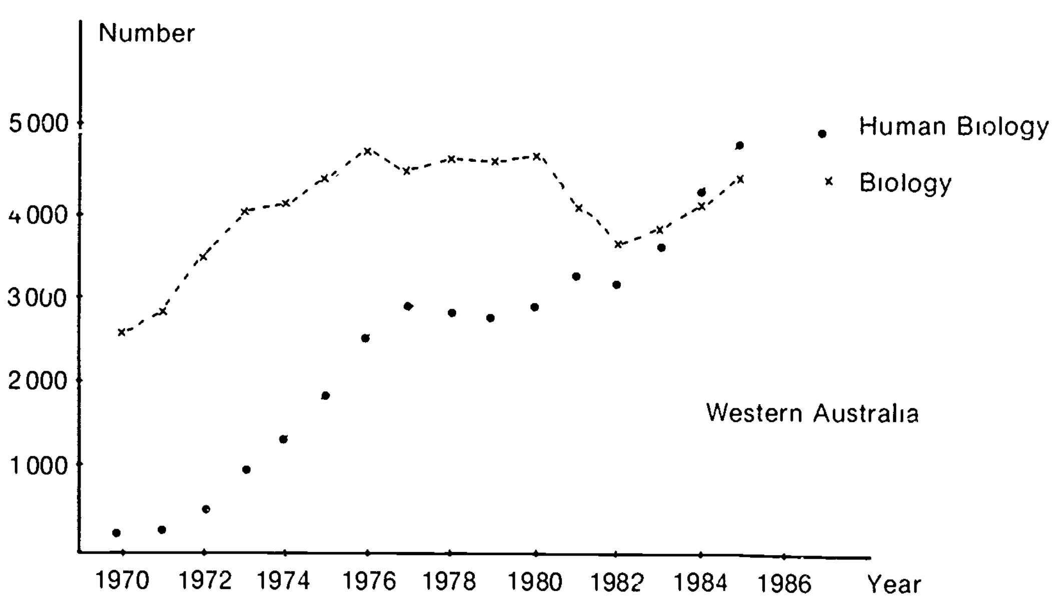


Figure 5 The number of students taking Biology and Human Biology in Western Australia from 1970-1985

## CHEMISTRY ENROLMENT STATISTICS

Male/female chemistry enrolments and their respective Parent-Year-8 and Peer-Year-12 populations for each State are presented in Table 4. The proportions of chemistry students with respect to the Peer-Year-12 and Parent-Year-8 base years are also presented. Figure 6 shows the variation of chemistry Year 12 enrolments over the period 1976-1985. The numbers have shown a steady, if unspectacular, growth over this period, from 24,739 in 1976 to 33,930 in 1985.

The statistical data in Table 4 on a State-by-State basis are depicted (in schematic form) in Figure 7. Of all the States, Queensland has shown the greatest increase in student numbers over the 1970-1985 period. Since 1975 the enrolments have increased from 4,340 to 6,899 (a 59% increase). Until the last few years most of this growth has resulted from increased female enrolments. However, despite this increase in the number of students studying chemistry, their proportion of the Peer-Year-12 population has declined to 0.623 (compared with the situation in 1970), due to the massive increase in retentivity (from 29.4% to 55.1%), over this period. This is in contrast to the proportion of the Parent-Year-8 population which has remained relatively constant from 1970-1985 except for a decline in the mid-1970's.

**Table 4:**
**Chemistry Enrolment Statistics in Australia**

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Chemistry Enrolments Male | Year 12 Chemistry Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| QUEENSLAND | | | | | | | | |
| 1966 | 32021 | | | | | | | |
| 1967 | 32242 | | | | | | | |
| 1968 | 33127 | | | | | | | |
| 1969 | 34043 | | | | | | | |
| 1970 | 34679 | 9407 | 29.4 | | | 4597 | 1.000 | 1.000 |
| 1971 | 35355 | 9883 | 30 7 | | | 4597 | 0.952 | 0.993 |
| 1972 | 36999 | 10770 | 32 5 | | | 5268 | 1 001 | 1.108 |
| 1973 | 37742 | 10973 | 32 2 | 3259 | 1297 | 4556 | 0.856 | 0.939 |
| 974 | 39595 | 11368 | 32.8 | 3182 | 1300 | 4482 | 0 808 | 0.901 |
| 1975 | 39805 | 11586 | 32.8 | 3012 | 1328 | 4340 | 0.767 | 0.855 |
| 1976 | 39493 | 12920 | 34.9 | 3195 | 1307 | 4502 | 0 713 | 0 848 |
| 1977 | 38780 | 13871 | 36.8 | 3321 | 1418 | 4739 | 0.699 | 0 875 |
| 1978 | 37962 | 14818 | 37.1 | 3422 | 1649 | 5071 | 0.701 | 0.892 |
| 1979 | 37696 | 14995 | 37 7 | 3349 | 1830 | 5179 | 0.707 | 0.907 |
| 1980 | 39319 | 15251 | 38 6 | 3446 | 1962 | 5408 | 0.726 | 0 954 |
| 1981 | 41149 | 15016 | 38.7 | 3236 | 2045 | 5281 | 0.720 | 0 949 |
| 1982 | 43800 | 15996 | 42.1 | 3329 | 2100 | 5429 | 0.695 | 0.096 |
| 1983 | 45672 | 17810 | 47.2 | 3674 | 2269 | 5943 | 0.683 | 1.098 |
| 1984 | 48007 | 20865 | 53 1 | 3963 | 2470 | 6433 | 0.631 | 1.140 |
| 1985 | 47338 | 22668 | 55 1 | 4303 | 2596 | 6899 | 0.623 | 1 168 |
| NEW SOUTH WALES | | | | | | | | |
| 1966 | 75233 | | | | | | | |
| 1967 | 76421 | | | | | | | |
| 1968 | 77983 | | | | | | | |
| 1969 | 79161 | | | | | | | |
| 1970 | 80421 | 23805 | 31.6 | | | | | |
| 1971 | 82712 | 24822 | 32.5 | | | | | |
| 1972 | 83534 | 26564 | 34 1 | | | | | |
| 1973 | 84807 | 27061 | 34.2 | | | | | |
| 1974 | 86619 | 26837 | 33.4 | | | | | |
| 1975 | 88735 | 28014 | 33 9 | | | | | |
| 1976 | 87605 | 29222 | 35 0 | 5931 | 2350 | 8281 | 1.000 | 1 000 |
| 1977 | 86289 | 30652 | 36.1 | 5920 | 2584 | 8504 | 0 979 | 1 012 |
| 1978 | 83230 | 31276 | 36 1 | 6346 | 2917 | 9263 | 1.045 | 1.079 |
| 1979 | 81995 | 30927 | 34 9 | 6433 | 3261 | 9694 | 1 106 | 1.102 |
| 1980 | 81891 | 28881 | 33.0 | 6328 | 3635 | 9963 | 1 217 | 1.147 |
| 1981 | 82439 | 28411 | 32.9 | 5591 | 3320 | 8911 | 1 107 | 1.042 |
| 1982 | 85509 | 28075 | 33.7 | 5582 | 3423 | 9005 | 1 132 | 1 091 |
| 1983 | 86881 | 30712 | 37.5 | 6215 | 3812 | 10027 | 1 152 | 1 234 |
| 1984 | 92284 | 33784 | 41 3 | 6309 | 3884 | 10193 | 1.065 | 1.256 |
| 1985 | 94397 | 34261 | 41.6 | 6453 | 4292 | 10745 | 1.107 | 1 315 |

## Table 4: (contd)

### Chemistry Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Chemistry Enrolments Male | Year 12 Chemistry Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| AUSTRALIAN CAPITAL TERRITORY | | | | | | | | |
| 1973 | 3211 | | | | | | | |
| 1974 | 3469 | | | | | | | |
| 1975 | 3824 | | | | | | | |
| 1976 | 3877 | | | | | | | |
| 1977 | 3978 | 2136 | 66.5 | 299 | 137 | 436 | 1.000 | 1.000 |
| 1978 | 3858 | 2317 | 66.8 | 391 | 167 | 558 | 1.180 | 1.185 |
| 1979 | 4002 | 2578 | 67.4 | 411 | 257 | 668 | 1.269 | 1.287 |
| 1980 | 3976 | 2538 | 65.5 | 429 | 262 | 691 | 1.338 | 1.313 |
| 1981 | 4056 | 2675 | 67.2 | 415 | 309 | 624 | 1.143 | 1.155 |
| 1982 | 4248 | 2720 | 70.5 | 408 | 392 | 800 | 1.441 | 1.527 |
| 1983 | 4652 | 2918 | 72.9 | 457 | 391 | 848 | 1.424 | 1.561 |
| 1984 | 5065 | 3145 | 79.1 | 435 | 391 | 826 | 1.287 | 1.530 |
| 1985 | 5107 | 3150 | 77.7 | 400 | 395 | 795 | 1.236 | 1.444 |
| VICTORIA | | | | | | | | |
| 1966 | 60154 | | | | | | | |
| 1967 | 59858 | | | | | | | |
| 1968 | 61490 | | | | | | | |
| 1969 | 62762 | | | | | | | |
| 1970 | 63801 | 18915 | 31.4 | 4782 | 1554 | 6336 | 1.000 | 1.000 |
| 1971 | 65185 | 19221 | 32.1 | 4723 | 1529 | 6252 | 0.972 | 0.967 |
| 1972 | 66938 | 20367 | 33.1 | 4423 | 1562 | 5985 | 0.877 | 0.924 |
| 1973 | 67267 | 21416 | 34.1 | 4544 | 1675 | 6219 | 0.867 | 0.941 |
| 1974 | 69520 | 21465 | 33.6 | 4325 | 1721 | 6046 | 0.841 | 0.900 |
| 1975 | 69672 | 22930 | 35.2 | 4348 | 2031 | 6379 | 0.831 | 0.929 |
| 1976 | 69052 | 23580 | 35.2 | 4355 | 2056 | 6411 | 0.812 | 0.909 |
| 1977 | 68034 | 22884 | 34.0 | 4348 | 2199 | 6547 | 0.854 | 0.924 |
| 1978 | 66932 | 23046 | 33.1 | 4400 | 2409 | 6809 | 0.882 | 0.930 |
| 1979 | 65684 | 22528 | 32.3 | 4287 | 2533 | 6820 | 0.984 | 0.929 |
| 1980 | 67019 | 22580 | 32.7 | 4190 | 2634 | 6824 | 0.902 | 0.938 |
| 1981 | 67866 | 22573 | 33.2 | 4246 | 2757 | 7003 | 0.926 | 0.977 |
| 1982 | 71461 | 23050 | 34.4 | 4168 | 2871 | 7039 | 0.912 | 0.998 |
| 1983 | 71048 | 25395 | 38.7 | 4287 | 2906 | 7193 | 0.845 | 1.040 |
| 1984 | 74594 | 28971 | 43.2 | 4475 | 2987 | 7462 | 0.769 | 1.057 |
| 1985 | 73092 | 30706 | 45.2 | 4503 | 3251 | 7754 | 0.754 | 1.085 |
| TASMANIA | | | | | | | | |
| 1966 | 7890 | | | | | | | |
| 1967 | 7746 | | | | | | | |
| 1968 | 7762 | | | | | | | |
| 1969 | 8352 | | | | | | | |
| 1970 | 8162 | 1358 | 17.2 | | | 884 | 1.000 | 1.000 |
| 1971 | 8112 | 1581 | 20.4 | | | 873 | 0.848 | 1.006 |
| 1972 | 8148 | 1787 | 23.0 | 537 | 195 | 732 | 0.629 | 0.842 |
| 1973 | 8205 | 1966 | 23.5 | 495 | 180 | 675 | 0.527 | 0.721 |
| 1974 | 8532 | 1864 | 22.8 | 465 | 168 | 633 | 0.522 | 0.692 |
| 1975 | 8555 | 2086 | 25.7 | 421 | 174 | 595 | 0.438 | 0.655 |
| 1976 | 8228 | 2079 | 25.5 | 408 | 149 | 557 | 0.412 | 0.610 |
| 1977 | 8238 | 2113 | 25.8 | 972 | 393 | 1159 | 0.843 | 1.261 |
| 1978 | 7797 | 2099 | 24.6 | 783 | 382 | 1165 | 0.853 | 1.219 |
| 1979 | 7409 | 2215 | 25.9 | 763 | 394 | 1157 | 0.802 | 1.208 |
| 1980 | 7344 | 2237 | 27.2 | 791 | 380 | 1071 | 0.727 | 1.149 |
| 1981 | 7358 | 2203 | 26.7 | 682 | 346 | 1028 | 0.717 | 1.114 |
| 1982 | 7914 | 1716 | 22.0 | 679 | 315 | 994 | 0.890 | 1.138 |
| 1983 | 7939 | 1845 | 24.9 | 773 | 354 | 1127 | 0.938 | 1.358 |
| 1984 | 821[illegible] | 2033 | 27.7 | 694 | 331 | 1025 | 0.775 | 1.246 |
| 1985 | 8072 | 2126 | 28.9 | 616 | 353 | 969 | 0.700 | 1.175 |

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## Table 4: (contd)

### Chemistry Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Chemistry Enrolments Male | Year 12 Chemistry Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| SOUTH AUSTRALIA | | | | | | | | |
| 1966 | 22566 | | | | | | | |
| 1967 | 22965 | | | | | | | |
| 1968 | 23081 | | | | | | | |
| 1969 | 23448 | | | | | | | |
| 1970 | 23911 | 5972 | 26.5 | | | 3124 | 1.000 | 1.000 |
| 1971 | 24040 | 6836 | 29.8 | | | 3104 | 0.868 | 0.976 |
| 1972 | 24545 | 7468 | 32.4 | | | 3147 | 0.806 | 0.985 |
| 1973 | 25418 | 7730 | 33.0 | 2259 | 778 | 3037 | 0.75[illegible] | 0.936 |
| 1974 | 25527 | 7758 | 32.4 | 2046 | 705 | 2751 | 0.678 | 0.831 |
| 1975 | 25366 | 8670 | 36.1 | 1975 | 685 | 2660 | 0.587 | 0.799 |
| 1976 | 24592 | 9093 | 37.0 | 1878 | 645 | 2523 | 0.530 | 0.743 |
| 1977 | 23902 | 9066 | 35.[illegible] | 1752 | 753 | 2505 | 0.528 | 0.712 |
| 1978 | 23364 | 9124 | 35.7 | 1722 | 852 | 2574 | 0.545 | 0.728 |
| 1979 | 22390 | 9356 | 36.9 | 1836 | 879 | 2715 | 0.555 | 0.773 |
| 1980 | 22115 | 9535 | 38.8 | 1897 | 928 | 2825 | 0.566 | 0.830 |
| 1981 | 22893 | 9308 | 38.9 | 1837 | 929 | 2766 | 0.568 | 0.836 |
| 1982 | 23695 | 9580 | 41.0 | 1890 | 1097 | 2987 | 0.596 | 0.923 |
| 1983 | 23851 | 10653 | 47.6 | 2100 | 1136 | 3236 | 0.581 | 1.044 |
| 1984 | 23483 | 11087 | 50.1 | 2019 | 1092 | 3111 | 0.536 | 1.016 |
| 1985 | 22657 | 11711 | 51.2 | 2000 | 1099 | 3099 | 0.506 | 0.978 |
| WESTERN AUSTRALIA | | | | | | | | |
| 1966 | 17411 | | | | | | | |
| 1967 | 17637 | | | | | | | |
| 1968 | 19059 | | | | | | | |
| 1969 | 19333 | | | | | | | |
| 1970 | 20064 | 4680 | 26.9 | 1871 | 465 | 2336 | 1.000 | 1.000 |
| 1971 | 20145 | 4866 | 27.6 | 1880 | 531 | 2411 | 0.993 | 1.019 |
| 1972 | 20642 | 5648 | 29.6 | 1917 | 604 | 2521 | 0.894 | 0.986 |
| 1973 | 21202 | 6121 | 31.7 | 1882 | 564 | 2446 | 0.801 | 0.943 |
| 1974 | 22028 | 6581 | 32.8 | 1927 | 648 | 2575 | 0.784 | 0.957 |
| 1975 | 22414 | 6870 | 34.1 | 1822 | 685 | 2507 | 0.731 | 0.928 |
| 1976 | 22665 | 7380 | 35.7 | 1795 | 670 | 2465 | 0.669 | 0.890 |
| 1977 | 22371 | 7416 | 35.0 | 1800 | 779 | 2579 | 0.697 | 0.907 |
| 1978 | 21861 | 7543 | 34.2 | 1744 | 927 | 2671 | 0.709 | 0.904 |
| 1979 | 22198 | 7631 | 34.0 | 1981 | 1060 | 3041 | 0.828 | 1.049 |
| 1980 | 2211[illegible] | 7700 | 34.0 | 1591 | 922 | 2513 | 0.769 | 0.972 |
| 1981 | 23262 | 7843 | 35.1 | 1584 | 806 | 2390 | 0.611 | 0.796 |
| 1982 | 24213 | 8184 | 37.4 | 1917 | 1126 | 3043 | 0.745 | 1.037 |
| 1983 | 25014 | 8970 | 40.4 | 2063 | 1270 | 3333 | 0.74[illegible] | 1.119 |
| 1984 | 2612[illegible] | 10090 | 45.6 | 2101 | 1280 | 3381 | 0.6[illegible] | 1.140 |
| 1985 | 25138 | 11059 | 47.5 | 2244 | 1425 | 3669 | 0.665 | 1.176 |

* Peer-Year-12 Proportion in 198X =

$$\frac{\text{Year 12 Chemistry Enrolment in 198X}}{\text{Year 12 Chemistry Enrolment in base year}} \times \frac{\text{Peer Year 12 Population in base year}}{\text{Peer Year 12 Population 198X}}$$

** Parent-Year-8 Proportion 198X =

$$\frac{\text{Year 12 Chemistry Enrolment in 198X}}{\text{Year 12 Chemistry Enrolment in base year}} \times \frac{\text{Parent Year 8 Population in base year}}{\text{Parent Year 8 Population 198(X-4)}}$$

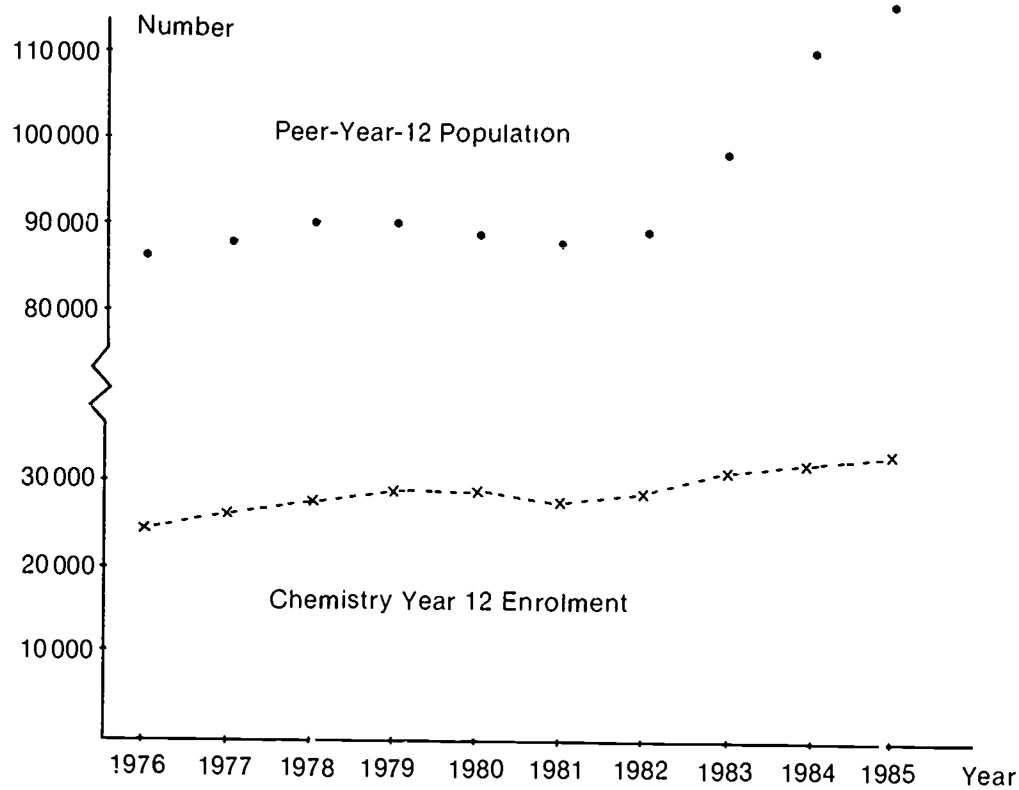


Figure 6 National trends for students taking Chemistry as a Public Examinations subject as compared to the Peer-Year-12 population over the period 1976-1985

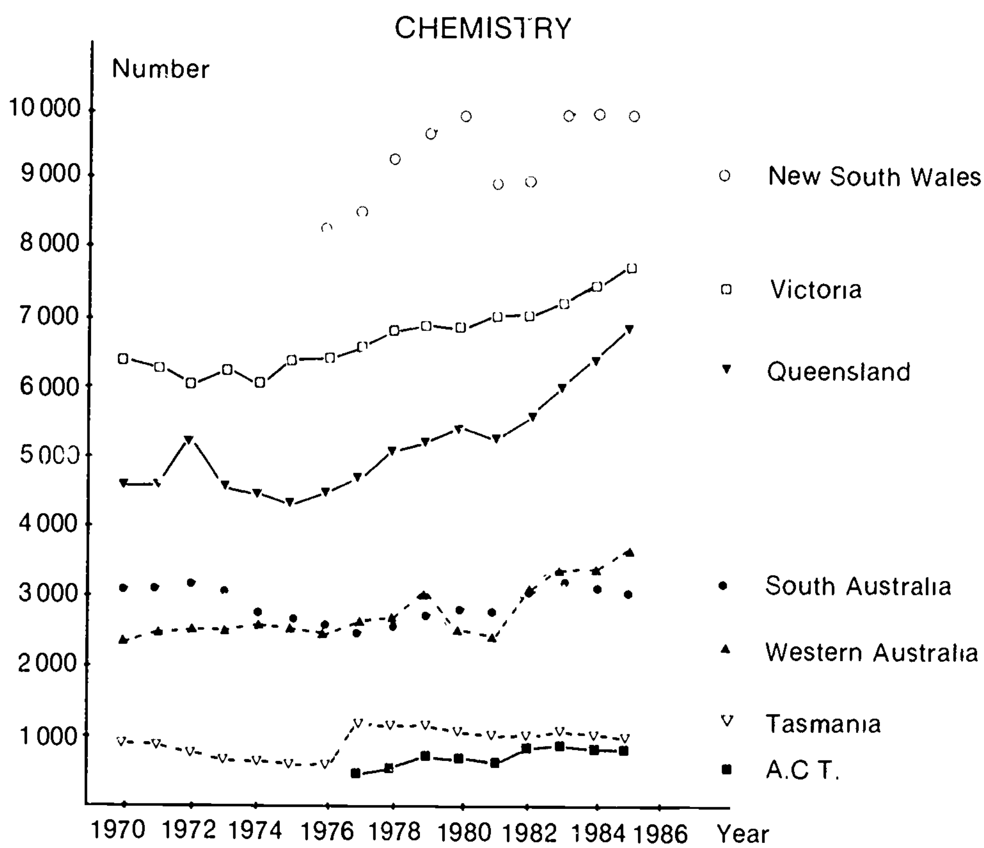


Figure 7 The number of students taking Chemistry as a Public Examinations subject from 1970-1985 (Victoria, Queensland, South Australia, Western Australia and Tasmania), from 1976-1985 (New South Wales), and from 1977-1985 (ACT)

New South Wales has the largest number of students studying chemistry, but the data are only listed since 1976 because in that year the pattern of secondary education changed in that State. Enrolment data since 1983 represent enrolments for students taking 2 Unit Chemistry. The NSW enrolments as a proportion of Parent-Year-8 and Peer-Year-12 have exceeded the base year for essentially all of the 1976-1985 period, although the actual numbers have varied considerably. The growth in the number of females studying chemistry has increased by approximately 83% over the 10-year period, although the number of males has remained relatively constant.

The data for the ACT from 1977-1985 are listed in Table 4 and displayed in Figure 7. The data show a steady increase in chemistry enrolments from 1977-1985, with the female enrolments increasing at a faster rate rather than the male enrolments. The proportion of chemistry enrolments to the Parent-Year-8 and the Peer-Year-12 populations with respect to the 1977 base year, exceed unity for each year of the period and represents the healthiest situation of all the States. It should be noted that the ACT retentivity of 77.7% in 1985 is the highest in the nation.

A physical science unit is offered in the ACT, and 143 students enrolled in the subject in 1985 *(see Table 7)*. This is a significant number when compared to the 795 students enrolled in chemistry. The ACT also offers units in Applied Science, Astronomy, Electronics, Oceanography and Technology, and these subjects will be discussed later in this chapter.

The Victorian numbers have shown a steady increase over the 1970-1985 period. In contrast to NSW, the proportion of chemistry Year 12 enrolments with respect to the Peer-Year-12 population has declined since the 1970 base year, although with respect to the Parent-Year-8 population it has remained close to unity for most of the period. The growth in actual numbers has occurred because of the increasing interest in chemistry by females, whereas the number of males enrolled in the subject has actually declined.

The Tasmanian chemistry enrolments show an interesting trend in that from 1970-1976 they averaged approximately 700 whereas from 1977-1985 the average was approximately 1,100 In 1977 the new subjects Chemistry A and B were introduced, but the existing subject was not phased out until 1978. Students were able to enrol in any of the three chemistry subjects. The overall chemistry enrolments have remained relatively stable since 1977 and there has been little variation in the proportion with respect to Parent-Year- 8 or Peer-Year-12 populations.

The enrolments in South Australia are approximately identical in 1985 as they were in 1970, although a decline occurred for most of the period covered in this review. Modest increases in female enrolments have been offset by a small decline in male enrolments. Since the retentivity from Year 8 to Year 12 in South Australia has increased from 26.5% in 1970 to 51.2% in 1985, it is apparent that the proportion of students studying chemistry compared to the Peer-Year-12 population must have declined. In fact in 1985 the proportion was only 0.506 of the 1970 base year. However, with respect to the Parent-Year-8 population, the situation is not as serious, for despite the fact that throughout most of the period the proportion was less than the base year, the proportion exceeded unity in 1983 and 1984.

The Western Australian enrolments have shown a steady if unspectacular growth over the 1970-1985 period. This has been caused by a significant increase in the number of females opting to study the subject, from approximately 500 in the early 1970's to approximately 1,300 students in the last few years. However, it is disappointing to note that the number of males has not increased significantly over the same period. As would be expected, the proportion of students enrolled in chemistry compared to the Peer-Year-12 population has declined over the period as the retentivity of students has increased, but with respect to the Parent-Year-8 population some gains are now evident.

An examination of the Western Australian enrolments indicate a sudden drop in 1980 and 1981 followed by a strong growth from 1982 to 1985. This is due, at least in part, to the introduction of a new Public Examinations subject entitled Physical Science, which was examined for the first time in 1979. This subject incorporates material which would normally be classified as "chemistry" and "physics". Few students opted to study this new subject in 1979 as it was being trialled in a relatively small number of schools. The number increased to 444 in 1980 and has steadily increased so that 796 students were enrolled in 1985 *(see Table 7)*.

The introduction of the subject Physical Science may have caused a drop in the number of students opting for Chemistry in 1980 and 1981, since the Physical Science unit could be substituted for Chemistry as an entry to many tertiary level courses. However, the effect appears to have been short-lived, and the Chemistry numbers now exceed their previous total whilst the Physical Science numbers have been sustained. It could be argued that the Chemistry numbers for Western Australia in Table 4 should be increased in the period 1979-1985 to include the additional Physical Science students. It is apparent that this new subject is attracting a new clientele of students and is not undercutting, to any serious extent, the number of students enrolled in chemistry.

It is also of interest to note that Victoria introduced a physical science subject in 1983. The unit has had an average enrolment of approximately 120 from 1983-1985 (see Table 7), but it is too early to comment on its effectiveness in the Victorian context.

## GEOLOGY ENROLMENT STATISTICS

The number of male and female geology students and their respective Parent-Year-8 and Peer-Year 12 population for each State are presented in Table 5 together with the proportions of geology students with respect to the Peer-Year-12 and Parent-Year-8 ba ɜ years. Figure 8 shows the variation of geology Year 12 enrolments over the period 1976-1985. The numbers have shown a slow but steady decline throughout this period, from 4,124 in 1976 to 3,128 in 1985.

The statistical data in Table 5 is depicted in Figure 9 in schematic form on a State-by-State basis. The Queensland enrolments were extremely low in the early 1970's but increased dramatically in 1976 and 1977 after which the numbers have remained approximately constant. The increase in the number of females studying geology has been remarkable since approximately 50 females were enrolled in the early 1970's compared to approximately 200 since 1976. In the same period the number of males studying geology has more than doubled. The proportion of students studying geology with respect to the 1970 base year has been in excess of unity for every year of the 1970-1985 period for both Parent-Year-8 and Peer-Year-12 populations. In fact, in 1983 the proportion with respect to the Parent-Year-8 population was 3.6 times the number in 1970.

**Table 5:**

**Geology Enrolment Statistics in Australia**

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Geology Enrolments Male | Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| QUEENSLAND | | | | | | | | |
| 1966 | 32021 | | | | | | | |
| 1967 | 32242 | | | | | | | |
| 1968 | 33127 | | | | | | | |
| 1969 | 34043 | | | | | | | |
| 1970 | 34679 | 9407 | 29.4 | | | 176 | 1.000 | 1.000 |
| 1971 | 35355 | 9883 | 30.7 | | | 271 | 1.466 | 1.529 |
| 1972 | 36999 | 10770 | 32 5 | | | 326 | 1 618 | 1.790 |
| 1973 | 37742 | 10973 | 32.2 | 211 | 43 | 254 | 1.242 | 1 363 |
| 1974 | 39595 | 11368 | 32.8 | 171 | 51 | 222 | 1.044 | 1.165 |
| 1975 | 39805 | 11586 | 32.8 | 178 | 41 | 219 | 1 012 | 1.127 |
| 1976 | 39493 | 12920 | 34.9 | 370 | 118 | 488 | 1 853 | 2.203 |
| 1977 | 38780 | 13871 | 36.8 | 449 | 210 | 659 | 2.540 | 3.177 |
| 1978 | 37962 | 14818 | 37.1 | 431 | 201 | 632 | 2.283 | 2.907 |
| 1979 | 37696 | 14995 | 37.7 | 393 | 195 | 588 | 2.103 | 2.699 |
| 1980 | 39319 | 15251 | 38.6 | 411 | 199 | 610 | 2 138 | 2 810 |
| 1981 | 41149 | 15016 | 38.7 | 414 | 192 | 606 | 2.157 | 2 843 |
| 1982 | 43800 | 15996 | 42.1 | 441 | 187 | 628 | 2 098 | 3.010 |
| 1983 | 45672 | 17810 | 47.2 | 506 | 232 | 738 | 2 215 | 3 562 |
| 1984 | 48007 | 20865 | 53.1 | 454 | 239 | 693 | 1.775 | 3.207 |
| 1985 | 47338 | 22668 | 55.1 | 536 | 186 | 722 | 1.702 | 3 192 |
| NEW SOUTH WALES | | | | | | | | |
| 1966 | 75233 | | | | | | | |
| 1967 | 76421 | | | | | | | |
| 1968 | 77983 | | | | | | | |
| 1969 | 79161 | | | | | | | |
| 1970 | 80421 | 23805 | 31.6 | | | | | |
| 1971 | 82712 | 24822 | 32.5 | | | | | |
| 1972 | 83534 | 26564 | 34.1 | | | | | |
| 1973 | 84807 | 27061 | 34 2 | | | | | |
| 1974 | 86619 | 26837 | 33 4 | | | | | |
| 1975 | 88735 | 28014 | 33.9 | | | | | |
| 1976 | 87605 | 29222 | 35.0 | 1059 | 319 | 1378 | 1.000 | 1.000 |
| 1977 | 86289 | 30652 | 36 1 | 941 | 349 | 1290 | 0.892 | 0 922 |
| 1978 | 83230 | 31276 | 36.1 | 879 | 310 | 1189 | 0 806 | 0 832 |
| 1979 | 81995 | 30927 | 34 9 | 822 | 347 | 1169 | 0.802 | 0.799 |
| 1980 | 81891 | 28881 | 33 0 | 656 | 271 | 927 | 0 681 | 0.641 |
| 1981 | 82439 | 28411 | 32 9 | 771 | 350 | 1121 | 0.837 | 0.788 |
| 1982 | 85509 | 28075 | 33.7 | 634 | 310 | 944 | 0.713 | 0.688 |
| 1983 | 86881 | 30712 | 37.5 | 782 | 336 | 1118 | 0 771 | 0 827 |
| 1984 | 92284 | 33784 | 41 3 | 766 | 377 | 1143 | 0.717 | 0.846 |
| 1985 | 94397 | 34261 | 41.6 | 656 | 258 | 914 | 0 566 | 0 672 |

## Table 5: (contd)
## Geology Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Geology Enrolments Male | Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| AUSTRALIAN CAPITAL TERRITORY | | | | | | | | |
| 1973 | 3211 | | | | | | | |
| 1974 | 3469 | | | | | | | |
| 1975 | 3824 | | | | | | | |
| 1976 | 3877 | | | | | | | |
| 1977 | 3978 | 2136 | 66.5 | 50 | 13 | 63 | 1.000 | 1 000 |
| 1978 | 3858 | 2317 | 66.8 | 55 | 9 | 64 | 0.937 | 0 940 |
| 1979 | 4002 | 2578 | 67.4 | 31 | 8 | 39 | 0.513 | 0 520 |
| 1980 | 3976 | 2538 | 65.5 | 39 | 5 | 44 | 0.588 | 0.578 |
| 1981 | 4056 | 2675 | 67.2 | 47 | 8 | 55 | 0.697 | 0.705 |
| 1982 | 4248 | 2720 | 0.5 | 54 | 9 | 63 | 0 785 | 0.832 |
| 1983 | 4651 | 2918 | 72.9 | 68 | 30 | 98 | 1 139 | 1 248 |
| 1984 | 5065 | 3145 | 79.1 | 63 | 16 | 79 | 0.852 | 1.013 |
| 1985 | 5107 | 3150 | 77.7 | 64 | 24 | 88 | 0.947 | 1.105 |
| VICTORIA | | | | | | | | |
| 1966 | 60154 | | | | | | | |
| 1967 | 59858 | | | | | | | |
| 1968 | 61490 | | | | | | | |
| 1969 | 62762 | | | | | | | |
| 1970 | 63801 | 18915 | 31.4 | 58 | 40 | 98 | 1 000 | 1.000 |
| 1971 | 65185 | 19221 | 32.1 | 54 | 42 | 96 | 0.964 | 0.984 |
| 1972 | 66938 | 20367 | 33 1 | 44 | 38 | 82 | 0.777 | 0.819 |
| 1973 | 67267 | 21416 | 34.1 | 38 | 42 | 80 | 0 721 | 0.782 |
| 1974 | 69520 | 21465 | 33.6 | 43 | 39 | 82 | 0 737 | 0 789 |
| 1975 | 69672 | 22930 | 35 2 | 26 | 37 | 63 | 0.530 | 0.593 |
| 1976 | 69052 | 23580 | 35.2 | 111 | 75 | 186 | 1.522 | 1.706 |
| 1977 | 68034 | 22884 | 34.0 | 145 | 152 | 297 | 2.505 | 2 710 |
| 1978 | 66932 | 23046 | 33.1 | 131 | 123 | 254 | 2.127 | 2.243 |
| 1979 | 65684 | 22528 | 32.3 | 142 | 164 | 306 | 2 622 | 2 696 |
| 1980 | 67019 | 22580 | 32.7 | 150 | 161 | 311 | 2 658 | 2.765 |
| 1981 | 67866 | 22573 | 33.2 | 128 | 129 | 257 | 2.197 | 2 319 |
| 1982 | 71461 | 23050 | 34.4 | 100 | 118 | 218 | 1.825 | 1.999 |
| 1983 | 71048 | 25395 | 38 7 | 127 | 132 | 259 | 1.968 | 2.420 |
| 1984 | 74594 | 28971 | 43.2 | 71 | 106 | 177 | 1 179 | 1 621 |
| 1985 | 73092 | 30706 | 45 2 | 102 | 64 | 166 | 1.043 | 1 501 |
| TASMANIA | | | | | | | | |
| 1966 | 7890 | | | | | | | |
| 1967 | 7746 | | | | | | | |
| 1968 | 7762 | | | | | | | |
| 1969 | 8352 | | | | | | | |
| 1970 | 8162 | 1358 | 17.2 | 480 | 1 000 | 1.000 | | |
| 1971 | 8112 | 1581 | 20.4 | 587 | 1 050 | 1 246 | | |
| 1972 | 8148 | 1787 | 23.0 | 435 | 155 | 590 | 0 934 | 1.249 |
| 1973 | 8205 | 1966 | 23.5 | 371 | 159 | 530 | 0.767 | 1 043 |
| 1974 | 8532 | 1864 | 22.8 | 370 | 148 | 518 | 0 786 | 1 043 |
| 1975 | 8555 | 2086 | 25.7 | 350 | 147 | 497 | 0 674 | 1 007 |
| 1976 | 8228 | 2079 | 25 5 | 344 | 212 | 556 | 0.757 | 1.122 |
| 1977 | 8238 | 3113 | 25.8 | 387 | 202 | 589 | 0.789 | 1 180 |
| 1978 | 7797 | 2099 | 24.6 | 402 | 209 | 611 | 0 824 | 1 177 |
| 1979 | 7409 | 2215 | 25.9 | 278 | 155 | 433 | 0.553 | 0.832 |
| 1980 | 7344 | 2237 | 27.0 | 251 | 146 | 397 | 0 492 | 0.777 |
| 1981 | 7358 | 2203 | 26 7 | 235 | 132 | 367 | 0.471 | 0 732 |
| 1982 | 7914 | 1716 | 22.0 | 210 | 128 | 338 | 0.557 | 0.713 |
| 1983 | 7939 | 1845 | 24.9 | 191 | 115 | 306 | 0 469 | 0.679 |
| 1984 | 8212 | 2033 | 27.7 | 203 | 102 | 305 | 0 424 | 0 683 |
| 1985 | 8072 | 2126 | 28.9 | 222 | 104 | 326 | 0.434 | 0.728 |

## Table 5:

### Geology Enrolment Statistics in Australia

| Year | Pare· Yea Populat. | Peer Year 12 Population | Retentivity % | Year 12 Geology Enrolments Male | Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| SOUTH AUSTRALIA | | | | | | | | |
| 1966 | 2256 | | | | | | | |
| 1967 | 22965 | | | | | | | |
| 1968 | 23081 | | | | | | | |
| 1969 | 23448 | | | | | | | |
| 1970 | 23911 | 5972 | 26.5 | | | | | |
| 1971 | 24040 | 6836 | 29.8 | | | | | |
| 1972 | 24545 | 7468 | 32.4 | | | | | |
| 1973 | 25418 | 7730 | 33.0 | 359 | 174 | 533 | 1.000 | 1.000 |
| 1974 | 25527 | 7758 | 32.4 | 447 | 264 | 711 | 1 329 | 1.308 |
| 1975 | 25366 | 8670 | 36.1 | 681 | 431 | 1112 | 1.860 | 2 035 |
| 1976 | 24592 | 9093 | 37.0 | 821 | 566 | 1387 | 2.212 | 2.486 |
| 1977 | 23902 | 9066 | 35.7 | 791 | 729 | 1529 | 2.446 | 2.646 |
| 1978 | 23364 | 9124 | 35 7 | 811 | 802 | 1613 | 2.564 | 2.780 |
| 1979 | 22390 | 9356 | 36 9 | 801 | 762 | 1563 | 2 423 | 2.711 |
| 1980 | 22115 | 9535 | 38.8 | 810 | 695 | 1505 | 2.289 | 2.692 |
| 1981 | 22893 | 9308 | 38 9 | 634 | 646 | 1280 | 1.994 | 2.356 |
| 1982 | 23695 | 9580 | 41.0 | 613 | 565 | 1178 | 1.783 | 2.218 |
| 1983 | 23851 | 10653 | 47.6 | 598 | 515 | 1113 | 1.515 | 2.187 |
| 1984 | 23483 | 11087 | 50.1 | 519 | 398 | 917 | 1.200 | 1.824 |
| 1985 | 22658 | 11711 | 51 2 | 441 | 305 | 746 | 0.924 | 1.434 |
| WESTERN AUSTRALIA | | | | | | | | |
| 1966 | 17411 | | | | | | | |
| 1967 | 17637 | | | | | | | |
| 1968 | 19059 | | | | | | | |
| 1969 | 19333 | | | | | | | |
| 1970 | 20064 | 4680 | 26.9 | 74 | 2 | 76 | 1 000 | 1.000 |
| 1971 | 20145 | 4866 | 27.6 | 116 | 7 | 123 | 1.577 | 1.598 |
| 1972 | 20642 | 5648 | 29 6 | 140 | 25 | 165 | 1.799 | 1 983 |
| 1973 | 21202 | 6121 | 31 7 | 120 | 14 | 134 | 1.348 | 1.538 |
| 1974 | 22028 | 6581 | 32.8 | 118 | 17 | 135 | 1.263 | 1.541 |
| 1975 | 22414 | 6870 | 34 1 | 139 | 14 | 153 | 1.371 | 1.740 |
| 1976 | 22665 | 7380 | 35.7 | 111 | 18 | 129 | 1.076 | 1.432 |
| 1977 | 22371 | 7416 | 35 0 | 119 | 24 | 143 | 1.187 | 1.545 |
| 1978 | 21861 | 7543 | 34 2 | 118 | 27 | 145 | 1.184 | 1.508 |
| 1979 | 22198 | 7631 | 34.0 | 88 | 26 | 114 | 0.920 | 1.165 |
| 1980 | 22110 | 7700 | 34.0 | 134 | 25 | 159 | 1 272 | 1.607 |
| 1981 | 23262 | 7843 | 35.1 | 154 | 16 | 170 | 1.335 | 1.751 |
| 1982 | 24213 | 8184 | 37.4 | 144 | 13 | 157 | 1.181 | 1.645 |
| 1983 | 25014 | 8970 | 40.4 | 150 | 22 | 172 | 1.181 | 1.775 |
| 1984 | 26126 | 10090 | 45.6 | 133 | 14 | 147 | 0.897 | 1.523 |
| 1985 | 25138 | 11059 | 47.5 | 149 | 17 | 166 | 0.924 | 1.634 |

* Peer-Year-12 Proportion in 198X =

$$\frac{\text{Year 12 Geology Enrolment in 198X}}{\text{Year 12 Geology Enrolment in base year}} \times \frac{\text{Peer Year 12 Population in base year}}{\text{Peer Year 12 Population 198X}}$$

** Parent-Year-8 Proportion 198X =

$$\frac{\text{Year 12 Geology Enrolment in 198X}}{\text{Year 12 Geology Enrolment in base year}} \times \frac{\text{Parent Year 8 Population in base year}}{\text{Parent Year 8 Population 198(X-4)}}$$

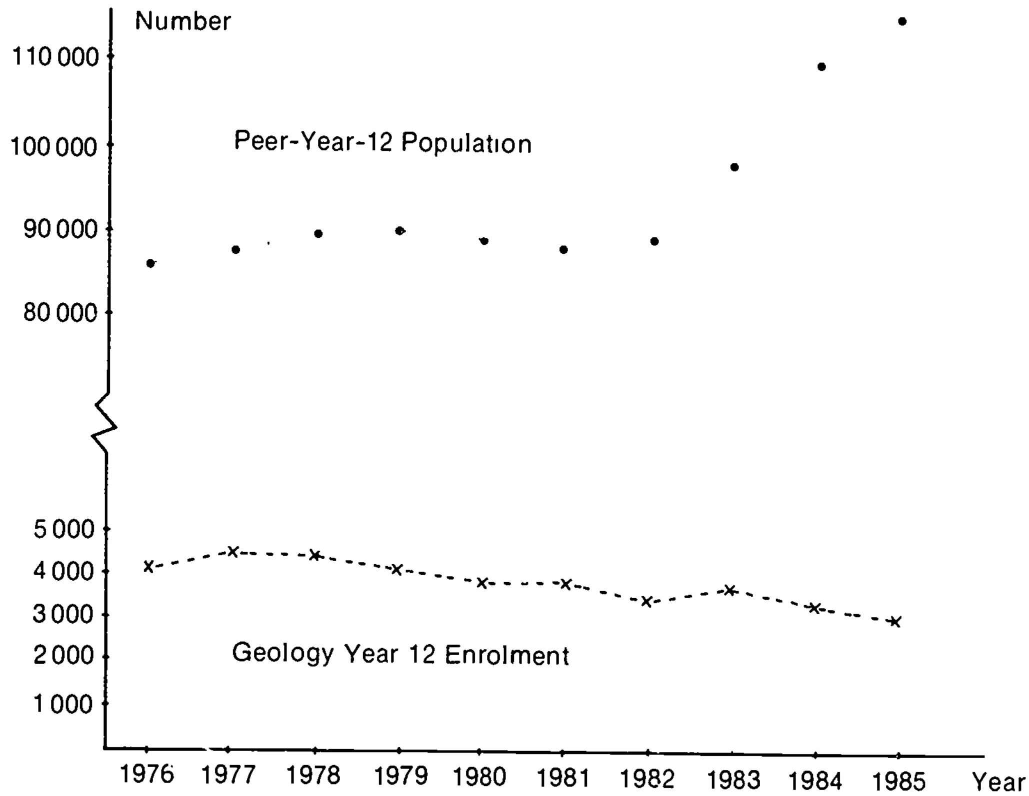


Figure 8 National trends for students taking Geology as a Public Examinations subject as compared to the Peer-Year-12 population over the period 1976-1985

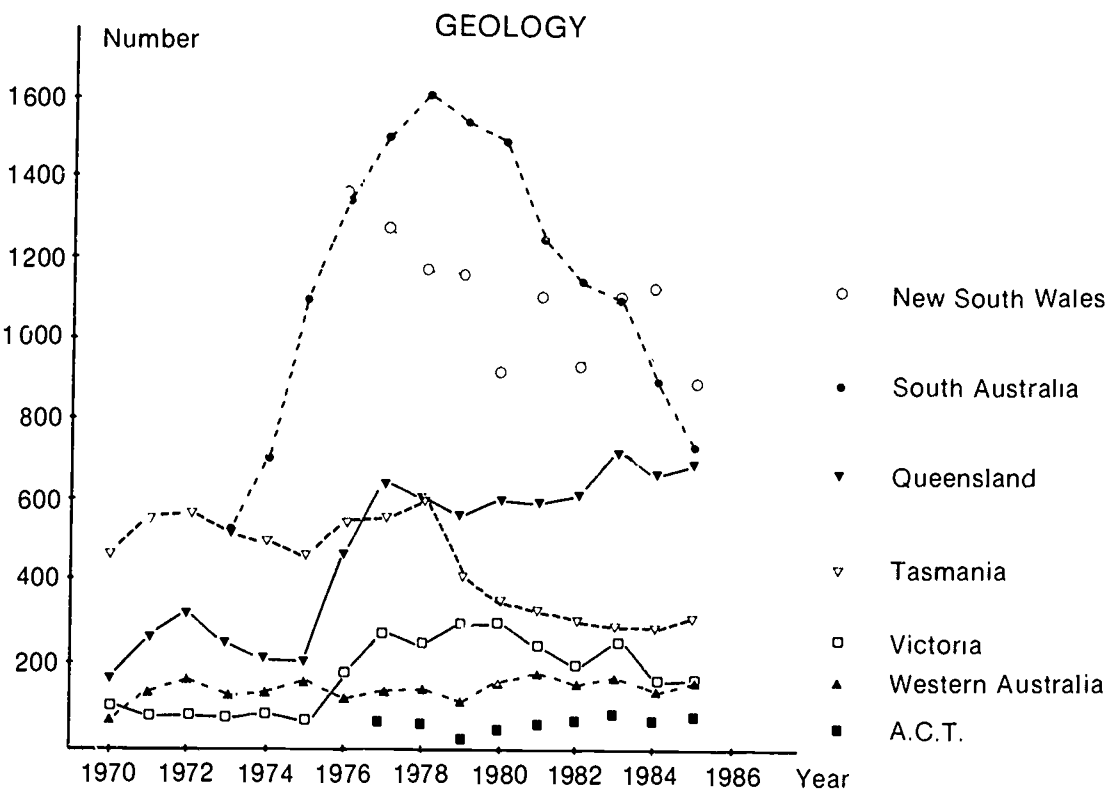


Figure 9: The number of students taking Geology as a Public Examinations subject from 1970-1985 (Victoria, Queensland, South Australia, Western Australia and Tasmania), from 1976-1985 (New South Wales), and from 1977-1985 (ACT)

For New South Wales, the data are only listed since 1976 because in that year the pattern of secondary education changed in that State. The geology enrolments in Table 5 represent the number of students enrolled in 4-unit and 2-unit courses. The numbers have declined somewhat over the 1976-1985 period, the decline primarily being brought about by a reduction in the male enrolments. The NSW enrolments, as a proportion of the Parent-Year- 8 and Peer-Year-12 population, have been less than the base year for the total period.

The number of geology students in the ACT is also extremely small, averaging 66 per year from 1977-1985. The female enrolment has been approximately 14 per year. In 1983 a new subject entitled Earth Science was introduced in the ACT. The data listed in Table 5 for 1984 and 1985 includes both the Geology and Earth Science enrolments.

The Victorian enrolments in geology in the 1970-1975 period were exceptionally low for a State with such a large age cohort. However, subsequent to 1975 the numbers trebled to a high point of 311 in 19[illegible], before declining to 166 in 1985. It is significant that, from 1979 to 1984, females have exceeded the number of male enrolments.

The Tasmanian enrolments averaged 550 students per year over the 1970-1978 period, but subsequent to this there has been a steady decline to just over 300 students in 1984 and 1985. The proportion of students studying geology with respect to the Peer-Year-12 population has now declined to approximately 43% of the 1970 year, and even the Parent-Year-8 proportion is now less than unity. The decline in the enrolments has been caused primarily by a drop in male enrolments, but female enrolments have also declined to approximately 50% of the maximum number during this period.

The South Australian enrolments in geology have shown a massive change since the subject was introduced in 1973 The numbers showed a three-fold increase from 1973 to 1978, but subsequently there has been a steady decline so that the 1985 enrolment of 746 is the lowest since 1974. However, the proportion of students studying geology, when compared to both the Parent-Year-8 and the Peer-Year-12 populations, exceeds unity for each year of the 1973-1984 period when compared to the base year. The male and female enrolments show similar trends over the 1973-1985 period.

The geology enrolments in Western Australia have not varied greatly since 1971, averaging about 150 students per year over this period. It is surprising that geology does not have a stronger enrolment in this mineral-rich State, but very few schools are able to offer geology as a Public Examinations subject. The number of females studying geology is extremely low, averaging 18 students per year over the 16-year period.

## PHYSICS ENROLMENT STATISTICS

The number of male and female physics students and their respective Parent-Year-8 and Peer-Year-12 populations for each State are presented in Table 6 together with the proportions of physics students with respect to the Peer-Year-12 and Parent-Year-8 base years. The variation of physics Year 12 enrolments over the time period 1976-1985 is shown in Figure 10. The numbers are remarkedly constant, and although there have been small increases from 1983, these are not commensurate with the Year 12 population increase. In 1985 there was a total of 29,018 physics enrolments. The physics enrolment trends closely approximate the chemistry enrolment trends over the same period of time *(see Figure 6)*.

The statistical data in Table 6 on a State-by- State basis is depicted (in schematic form) in Figure 11. Queensland enrolments have shown an increase, particularly from 1982 to 1985. However, in terms of the Peer-Year-12 population the proportion has been decreasing, even in 1983-1985 when the actual numbers have shown a dramatic growth. This is due to the increase in retentivity which has occurred in Queensland - from 29.4% in 1970 to 55.1% in 1985 On the other hand, the proportion of students studying physics with respect to the Parent-Year-8 population has been maintained over this 16-year period.

New South Wales has the largest number of students in physics and, together with Victoria, make up more than half the national total. The data for NSW commence in 1976 because in that year the pattern of secondary education changed. Data since 1983 represent enrolments for students taking the 2-unit Physics subject. The NSW enrolments as a proportion of Parent-Year-8 or Peer-Year-12 have remained relatively constant with respect to 1976. The male physics enrolment is at least 3 times as great as the female enrolment. The actual numbers have varied considerably, but during 1984-1985 they have increased from the low point of 1981-1982.

The statistics for the Australian Capital Territory are listed in Table 6 from 1977. The data show a steady growth in physics enrolments (from 484 in 1977 to 749 in 1985). The proportion of physics enrolments to the Peer-Year-12 population is greater than the 1977 base year throughout the period, as is the proportion with respect to the Parent-Year-8 population The proportion of females studying physics has also increased steadily throughout the past 7 years.

## Table 5:

### Physics Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Physics Enrolments Male | Year 12 Physics Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| QUEENSLAND | | | | | | | | |
| 1966 | 32021 | | | | | | | |
| 1967 | 32242 | | | | | | | |
| 1968 | 33127 | | | | | | | |
| 1969 | 34043 | | | | | | | |
| 1970 | 34679 | 9407 | 29.4 | | | 3988 | 1.000 | 1.000 |
| 1971 | 35355 | 9883 | 30.7 | | | 4135 | 0.987 | 1.030 |
| 1972 | 36999 | 10770 | 32.5 | | | 4791 | 1.049 | 1.161 |
| 1973 | 37742 | 10973 | 32.2 | 3186 | 904 | 4099 | 0.886 | 0.972 |
| 1974 | 39595 | 11368 | 32.8 | 3066 | 863 | 3929 | 0.816 | 0.911 |
| 1975 | 39805 | 11586 | 32.8 | 2924 | 892 | 3816 | 0.777 | 0.867 |
| 1976 | 39493 | 12920 | 34.9 | 3070 | 813 | 3892 | 0.711 | 0.845 |
| 1977 | 38780 | 13871 | 36.8 | 3167 | 929 | 4096 | 0.697 | 0.872 |
| 1978 | 37962 | 14818 | 37.1 | 3273 | 1035 | 4308 | 0.686 | 0.874 |
| 1979 | 37696 | 14995 | 37.7 | 3150 | 1136 | 4286 | 0.674 | 0.865 |
| 1980 | 39319 | 15251 | 38.6 | 3236 | 1148 | 4384 | 0.678 | 0.891 |
| 1981 | 41149 | 15016 | 38.7 | 3078 | 1165 | 4243 | 0.667 | 0.879 |
| 1982 | 43800 | 15996 | 42.1 | 3170 | 1197 | 4367 | 0.644 | 0.924 |
| 1983 | 45672 | 17810 | 47.2 | 3435 | 1221 | 4656 | 0.617 | 0.992 |
| 1984 | 48007 | 20865 | 53.1 | 3725 | 1308 | 5033 | 0.569 | 1.028 |
| 1985 | 47338 | 22668 | 55.1 | 3969 | 1429 | 5398 | 0.562 | 1.053 |
| NEW SOUTH WALES | | | | | | | | |
| 1966 | 75233 | | | | | | | |
| 1967 | 76421 | | | | | | | |
| 1968 | 77983 | | | | | | | |
| 1969 | 79161 | | | | | | | |
| 1970 | 80421 | 23805 | 31.6 | | | | | |
| 1971 | 82712 | 24822 | 32.5 | | | | | |
| 1972 | 83534 | 26564 | 34.1 | | | | | |
| 1973 | 84807 | 27061 | 34.2 | | | | | |
| 1974 | 86619 | 26837 | 33.4 | | | | | |
| 1975 | 88735 | 28014 | 33.9 | | | | | |
| 1976 | 87605 | 29222 | 35.0 | 6890 | 1751 | 8641 | 1.000 | 1.000 |
| 1977 | 86289 | 30652 | 36.1 | 6750 | 1915 | 8665 | 0.956 | 0.988 |
| 1978 | 83230 | 31276 | 36.1 | 7049 | 2025 | 9074 | 0.981 | 1.013 |
| 1979 | 81995 | 30927 | 34.9 | 7122 | 2223 | 9345 | 1.022 | 1.018 |
| 1980 | 81891 | 28881 | 33.0 | 6848 | 2290 | 9138 | 1.070 | 1.008 |
| 1981 | 82439 | 28411 | 32.9 | 6122 | 1987 | 8109 | 0.965 | 0.908 |
| 1982 | 85509 | 28075 | 33.7 | 6134 | 1995 | 8129 | 0.979 | 0.944 |
| 1983 | 86881 | 30712 | 37.5 | 6877 | 2355 | 9232 | 1.017 | 1.088 |
| 1984 | 92284 | 33784 | 41.3 | 7003 | 2343 | 9346 | 0.936 | 1.103 |
| 1985 | 94397 | 34261 | 41.6 | 7005 | 2546 | 9551 | 0.943 | 1.120 |
| AUSTRALIAN CAPITAL TERRITORY | | | | | | | | |
| 1973 | 3211 | | | | | | | |
| 1974 | 3469 | | | | | | | |
| 1975 | 3824 | | | | | | | |
| 1976 | 3877 | | | | | | | |
| 1977 | 3978 | 2136 | 66.5 | 390 | 94 | 484 | 1.000 | 1.000 |
| 1978 | 3858 | 2317 | 66.8 | 491 | 108 | 599 | 1.141 | 1.14 |
| 1979 | 4002 | 2578 | 67.4 | 491 | 142 | 633 | 1.084 | 1.098 |
| 1980 | 3976 | 2538 | 65.5 | 489 | 143 | 632 | 1.099 | 1.081 |
| 1981 | 4056 | 2675 | 67.2 | 481 | 164 | 645 | 1.064 | 1.076 |
| 1982 | 4248 | 2720 | 70.5 | 475 | 230 | 705 | 1.144 | 1.212 |
| 1983 | 4651 | 2918 | 72.9 | 528 | 215 | 743 | 1.124 | 1.232 |
| 1984 | 5065 | 3145 | 79.1 | 564 | 253 | 817 | 1.146 | 1.363 |
| 1985 | 5107 | 3150 | 77.7 | 511 | 238 | 749 | 1.049 | 1.225 |

## Table 6: (cont)

### Physics Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Physics Enrolments Male | Year 12 Physics Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| VICTORIA | | | | | | | | |
| 1966 | 60154 | | | | | | | |
| 1967 | 59858 | | | | | | | |
| 1968 | 61490 | | | | | | | |
| 1969 | 62762 | | | | | | | |
| 1970 | 63801 | 18915 | 31.4 | 4945 | 1391 | 6336 | 1.000 | 1.000 |
| 1971 | 65185 | 19221 | 32.1 | 4892 | 1310 | 6202 | 0.963 | 0.984 |
| 1972 | 66938 | 20367 | 33.1 | 4531 | 1312 | 5843 | 0.861 | 0.902 |
| 1973 | 67267 | 21416 | 34.1 | 4552 | 1256 | 5808 | 0.810 | 0.879 |
| 1974 | 69520 | 21465 | 33.6 | 4322 | 1210 | 5532 | 0.769 | 0.823 |
| 1975 | 69672 | 22930 | 35.2 | 4230 | 1320 | 5550 | 0.723 | 0.808 |
| 1976 | 69052 | 23580 | 35.2 | 4109 | 1248 | 5357 | 0.678 | 0.760 |
| 1977 | 68034 | 22884 | 34.0 | 4056 | 1220 | 5276 | 0.688 | 0.745 |
| 1978 | 66932 | 23046 | 33.1 | 4217 | 1315 | 5532 | 0.717 | 0.755 |
| 1979 | 65684 | 22528 | 32.3 | 4126 | 1366 | 5492 | 0.728 | 0.748 |
| 1980 | 67019 | 22580 | 32.7 | 4057 | 1405 | 5462 | 0.722 | 0.751 |
| 1981 | 67866 | 22573 | 33.2 | 4132 | 1410 | 5542 | 0.733 | 0.773 |
| 1982 | 71461 | 23050 | 34.4 | 4050 | 1446 | 5496 | 0.712 | 0.780 |
| 1983 | 71048 | 25385 | 38.7 | 4097 | 1466 | 5563 | 0.654 | 0.804 |
| 1984 | 74594 | 28971 | 43.2 | 4322 | 1447 | 5769 | 0.594 | 0.817 |
| 1985 | 73092 | 30706 | 45.2 | 4352 | 1507 | 5859 | 0.570 | 0.820 |
| TASMANIA | | | | | | | | |
| 1966 | 7890 | | | | | | | |
| 1967 | 7746 | | | | | | | |
| 1968 | 7762 | | | | | | | |
| 1969 | 8352 | | | | | | | |
| 1970 | 8162 | 1358 | 17.2 | | | 850 | 1.000 | 1.000 |
| 1971 | 8112 | 1581 | 20.4 | | | 852 | 0.861 | 1.021 |
| 1972 | 8148 | 1787 | 23.0 | 595 | 195 | 790 | 0.706 | 0.945 |
| 1973 | 8205 | 1966 | 23.5 | 489 | 141 | 630 | 0.512 | 0.700 |
| 1974 | 8532 | 1864 | 22.8 | 460 | 135 | 595 | 0.510 | 0.661 |
| 1975 | 8555 | 2086 | 25.7 | 429 | 146 | 575 | 0.440 | 0.658 |
| 1976 | 8228 | 2079 | 25.5 | 674 | 207 | 881 | 0.677 | 1.004 |
| 1977 | 8238 | 3113 | 25.8 | 793 | 217 | 1010 | 0.764 | 1.143 |
| 1978 | 7797 | 2099 | 24.6 | 730 | 236 | 966 | 0.735 | 1.051 |
| 1979 | 7409 | 2215 | 25.9 | 735 | 213 | 948 | 0.684 | 1.029 |
| 1980 | 7344 | 2237 | 27.2 | 690 | 230 | 920 | 0.650 | 1.027 |
| 1981 | 7358 | 2203 | 26.7 | 684 | 206 | 890 | 0.645 | 1.003 |
| 1982 | 7914 | 1716 | 22.0 | 699 | 199 | 898 | 0.836 | 1.069 |
| 1983 | 7939 | 1845 | 24.9 | 787 | 224 | 1011 | 0.875 | 1.267 |
| 1984 | 8212 | 2033 | 27.7 | 702 | 184 | 886 | 0.696 | 1.120 |
| 1985 | 8072 | 2126 | 28.9 | 696 | 191 | 887 | 0.667 | 1.119 |

## Table 6: (contd)

### Physics Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Physics Enrolments Male | Year 12 Physics Enrolments Female | Total | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| SOUTH AUSTRALIA | | | | | | | | |
| 1966 | 22566 | | | | | | | |
| 1967 | 22965 | | | | | | | |
| 1968 | 23081 | | | | | | | |
| 1969 | 23448 | | | | | | | |
| 1970 | 23911 | 5972 | 26.5 | | | 3107 | 1.000 | 1.000 |
| 1971 | 24040 | 6836 | 29.8 | | | 3081 | 0.866 | 0.974 |
| 1972 | 24545 | 7468 | 32.4 | | | 3223 | 0.830 | 1.014 |
| 1973 | 25418 | 7730 | 33.0 | 2467 | 631 | 3098 | 0.770 | 0.960 |
| 1974 | 25527 | 7758 | 32.4 | 2293 | 558 | 2851 | 0.706 | 0.866 |
| 1975 | 25366 | 8670 | 36.1 | 2185 | 543 | 2728 | 0.605 | 0.884 |
| 1976 | 24592 | 9093 | 37.0 | 2101 | 531 | 2632 | 0.556 | 0.729 |
| 1977 | 23902 | 9066 | 35.7 | 2075 | 592 | 2667 | 0.565 | 0.762 |
| 1978 | 23364 | 9124 | 35.7 | 1999 | 689 | 2688 | 0.566 | 0.765 |
| 1979 | 22390 | 9356 | 36.9 | 2074 | 699 | 2773 | 0.570 | 0.794 |
| 1980 | 22115 | 9535 | 38.8 | 2192 | 740 | 2932 | 0.591 | 0.866 |
| 1981 | 22893 | 9308 | 38.9 | 2125 | 783 | 2908 | 0.600 | 0.884 |
| 1982 | 23695 | 9580 | 41.0 | 2199 | 929 | 3128 | 0.638 | 0.972 |
| 1983 | 23851 | 10653 | 47.6 | 2361 | 994 | 3365 | 0.607 | 1.092 |
| 1984 | 23483 | 11087 | 50.1 | 2311 | 947 | 3258 | 0.666 | 1.070 |
| 1985 | 22658 | 11711 | 51.2 | 2185 | 893 | 3078 | 0.505 | 0.977 |
| WESTERN AUSTRALIA | | | | | | | | |
| 1966 | 17411 | | | | | | | |
| 1967 | 17637 | | | | | | | |
| 1968 | 19059 | | | | | | | |
| 1969 | 19333 | | | | | | | |
| 1970 | 20064 | 4680 | 26.9 | 2096 | 403 | 2499 | 1.000 | 1.000 |
| 1971 | 20145 | 4866 | 27.6 | 2111 | 435 | 2546 | 0.980 | 1.006 |
| 1972 | 20642 | 5648 | 29.6 | 2095 | 465 | 2560 | 0.849 | 0.936 |
| 1973 | 21202 | 6121 | 31.7 | 2032 | 464 | 2496 | 0.764 | 0.900 |
| 1974 | 22028 | 6581 | 32.8 | 2054 | 559 | 2613 | 0.744 | 0.907 |
| 1975 | 22414 | 6870 | 34.1 | 1924 | 536 | 2460 | 0.671 | 0.851 |
| 1976 | 22665 | 7380 | 35.7 | 1803 | 573 | 2376 | 0.633 | 0.842 |
| 1977 | 22371 | 7416 | 35.0 | 1899 | 596 | 2495 | 0.639 | 0.820 |
| 1978 | 21861 | 7543 | 34.2 | 1813 | 723 | 2536 | 0.630 | 0.802 |
| 1979 | 22198 | 7631 | 34.0 | 1965 | 807 | 2772 | 0.708 | 0.897 |
| 1980 | 22110 | 7700 | 34.0 | 1645 | 585 | 2230 | 0.650 | 0.822 |
| 1981 | 23262 | 7843 | 35.1 | 1667 | 515 | 2182 | 0.521 | 0.680 |
| 1982 | 24213 | 8184 | 37.4 | 1966 | 861 | 2827 | 0.647 | 0.901 |
| 1983 | 25014 | 8970 | 40.4 | 2211 | 951 | 3162 | 0.660 | 0.992 |
| 1984 | 26126 | 10090 | 45.6 | 2208 | 1001 | 3209 | 0.596 | 1.011 |
| 1985 | 25138 | 11059 | 47.5 | 2410 | 1086 | 3496 | 0.592 | 1.047 |

* Peer-Year-12 Proportion in 198X =

$$\frac{\text{Year 12 Physics Enrolment in 198X}}{\text{Year 12 Physics Enrolment in base year}} \times \frac{\text{Peer Year 12 Population in base year}}{\text{Peer Year 12 Population 198X}}$$

** Parent-Year-8 Proportion 198X =

$$\frac{\text{Year 12 Physics Enrolment in 198X}}{\text{Year 12 Physics Enrolment in base year}} \times \frac{\text{Parent Year 8 Population in base year}}{\text{Parent Year 8 Population 198(X-4)}}$$

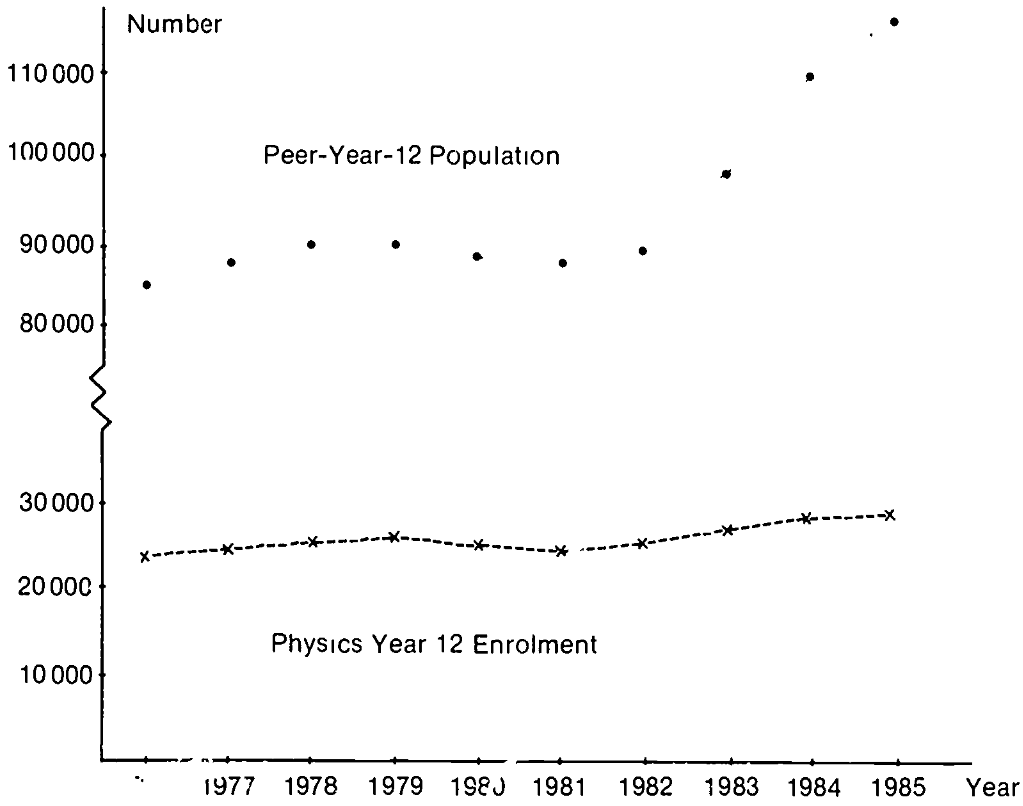


Figure 10. National trends for students taking Physics as a Public Examinations subject as compared to the Peer-Year-12 population over the period 1976-1985

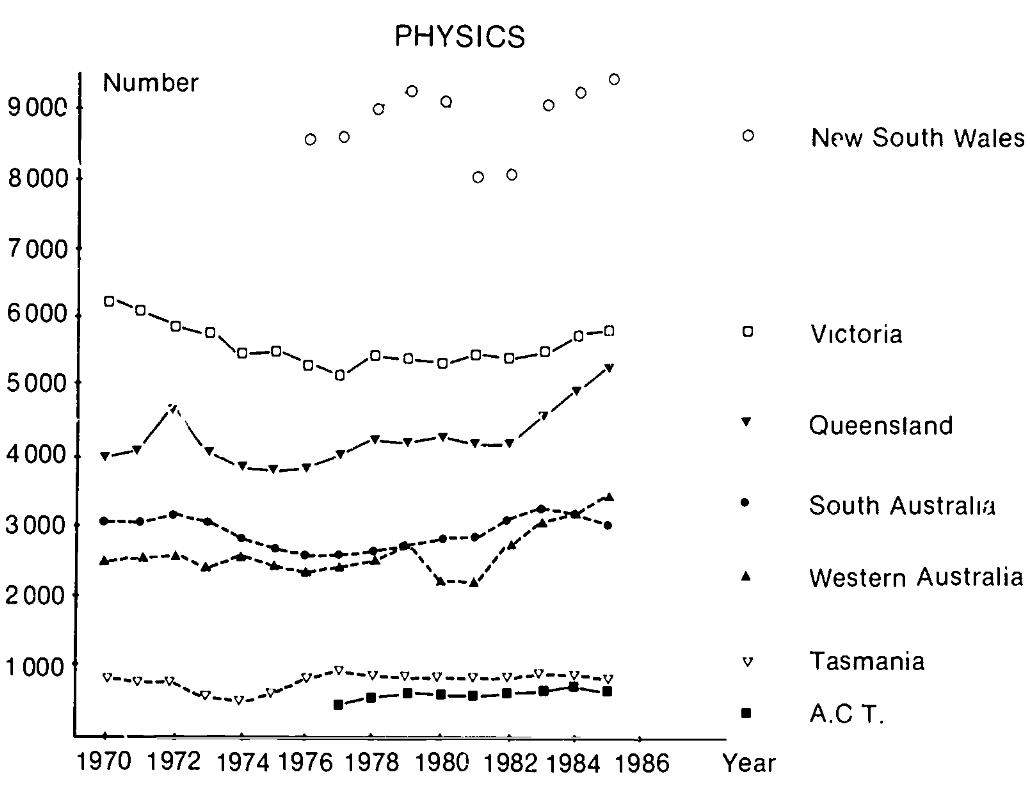


Figure 11 The number of students taking Physics as a Public Examinations subject from 1970-1985 (Victoria, Queensland, South Australia, Western Australia and Tasmania), from 1976-1985 (New South Wales) and from 1977-1985 (ACT)

The Victorian enrolment numbers declined from 1970-1977 but then stabilised and showed slight increases in 1984 and 1985. Over the 1970-1983 period the number of males has declined whilst the female numbers have shown a small increase The proportion of physics enrolments with respect to the Peer-Year-12 population has shown a dramatic drop from the 1970 base year, although this decline has not been quite as severe in terms of the Parent-Year-8 population.

The Tasmanian physics enrolments have remained relatively constant from 1970-1985. The proportion of physics enrolments with respect to the Parent-Year-8 population has been maintained since 1970 although with respect to the Peer-Year-12 population the proportion has fallen. There was a sudden rise in enrolments in 1976 caused by the introduction of the new subjects Physics A and B. Since the existing Physics subject was not phased out until 1977, three physics subjects were available at this time. The average proportion of females studying physics in Tasmania over the period 1980-1985 is approximately 22%.

The South Australian situation has been remarkably constant over the 1970-1985 period. After a downturn in the late 1970's the numbers are now essentially as they were in the early 1970's. The proportion of physics enrolments in 1985 with respect to the Peer-Year-12 group has decreased to 0.505 of the 1970 value, although the Parent-Year-8 proportion slightly exceeds the 1970 value in 1983 and 1984. The major factor in the recovery of the Physics numbers has been the increase in female numbers. Over the 1973-1985 period the male numbers have shown a slight decrease, so that approximately 30% of the Physics students are now female.

The Western Australian pattern in physics enrolments shows a similar trend to that in South Australia, and in fact the actual numbers between 1983 to 1985 are very similar. However, there has been a significant increase in the number of females opting for Physics - with over twice as many females studying the subject in 1982-1985 as there were in 1970-1971. The proportion of physics enrolments compared to the Peer-Year-12 population has declined to 0.592 in 1985 compared with the 1970 base year, although with respect to the Parent-Year-8 numbers the proportion has now returned to the 1970 level.

An examination of the Western Australian enrolments in Figure 11 indicates a sudden drop in 1980 and 1981, followed by a strong growth from 1982-1985. This is at least, in part, due to the introduction of a new Public Examinations subject entitled Physical Science, which was examined for the first time in 1979. This subject incorporates material which would normally be classified as 'physics' and 'chemistry'. Few students took the subject in 1979, as it was being trialled in a relatively small number of schools. The numbers increased to 444 in 1980 and have steadily increased to 796 students in 1985 (see Table 7). However, the effect on the physics enrolments was short-lived, and the physics enrolments now exceed their previous numbers, whilst the Physical Science numbers have also been sustained. Hence it could be argued that the physics numbers for Western Australia in Table 6 should be increased in the period 1979-1985 to include the additional Physical Science numbers. Another interesting observation is that whereas less than one-third of the total physics enrolments are females, the proportion is almost one half for the Physical Science enrolments. It is apparent that this new unit, although generally considered to be of similar difficulty to the physics and chemistry units, is attracting a much higher proportion of females, and is not seriously undercutting the number of students who opt for Physics and Chemistry.

It is also of interest to note that Victoria introduced a subject entitled Physical Science in 1983 with an enrolment of 92 students. However growth in enrolments, in contrast to Western Australia, has been relatively small.

## MISCELLANEOUS SCIENCE ENROLMENT STATISTICS

Apart from the major science subjects - Biology (including Human Biology), Chemistry, Geology (Earth Science) and Physics, there are a number of other science-based subjects which are offered as Public Examinations subjects in some States and the ACT. Most of these science subjects have only been offered in the 1980's.

### Physical Science

Although this subject has briefly been discussed in relationship to the chemistry and physics enrolments, the actual enrolment numbers for physical science have not been included in the statistics presented in Tables 4 and 6 and Figures 7 and 11, but are listed in Table 7.

The subject Physical Science was first offered in Western Australia in 1979 as an alternative to the subjects Chemistry and Physics. It is accepted as a suitable prerequisite for many tertiary level courses, and is generally considered to be a challenging subject. It includes material which could be considered as 'chemistry' or 'physics' with the 'chemical' content predominant. Table 7 lists the enrolment data for Western Australia, and for Victoria and the ACT where the subject has been introduced more recently.

The Physical Science enrolments in Western Australia increased dramatically when the subject was first introduced, then levelled off, but in 1985 again showed a significant increase. The proportion of females studying Physical Science is far greater than is the case for Chemistry and Physics.

## TABLE 7:

**Physical Science enrolment statistics in Western Australia, Victoria and the ACT**

| Year | Male | Female | Total |
|---|---|---|---|
| WESTERN AUSTRALIA | | | |
| 1979 | 88 | 26 | 114 |
| 1980 | 255 | 189 | 444 |
| 1981 | 283 | 263 | 546 |
| 1982 | 288 | 298 | 586 |
| 1983 | 323 | 335 | 658 |
| 1984 | 357 | 297 | 654 |
| 1985 | 451 | 345 | 796 |
| VICTORIA | | | |
| 1983 | 43 | 49 | 92 |
| 1984 | 82 | 37 | 119 |
| 1985 | 81 | 70 | 151 |
| A.C.T. | | | |
| 1983 | 23 | 37 | 60 |
| 1984 | 64 | 37 | 101 |
| 1985 | 74 | 69 | 143 |

Physical Science was introduced in 1983 in Victoria and the ACT, so it is not appropriate to draw any definitive conclusions from such limited data. The 151 students taking the subject in Victoria in 1985 is a very small percentage of the age cohort. However, the 143 ACT students studying Physical Science in 1985 represent a significant number with respect to those studying Chemistry and Physics.

### General Science

Subjects which are called General Science (in New South Wales and the ACT), Multistrand Science (in Queensland) or Multidisciplinary Science (in the ACT), have been introduced in recent years. The relevant data are listed in Table 8.

In Queensland, the Multistrand Science subject was introduced in 1980 and has shown sustained growth since that time. It is more popular with males than females but steady growth has been achieved for both sexes.

The 2 Unit General Science subject in New South Wales has been in operation since 1983, although in 1981-1982 it was known as 2UA Science. The enrolments are large and evenly distributed between males and females. It is obviously a popular subject and its popularity is increasing.

The ACT offers two subjects - one known as General Science and the other as Multidisciplinary Science. The former unit has been offered for only three years and the numbers are relatively small. The Multidisciplinary Science subject commenced in 1982 with a relatively large enrolment, but it has subsequently declined in numbers and has attracted no male enrolments in 1983 and 1984, and only 10 in 1985.

### Environmental Studies

This subject was introduced in Tasmania in 1980 and in Victoria and the ACT in 1983. The enrolments are listed in Table 9.

The Tasmanian enrolments have declined in each year the subject has been offered until 1985 when a significant increase occurred. The Victorian enrolment has averaged approximately 460 over 1984 and 1985 with the numbers being evenly distributed between males and females. The numbers in the ACT have averaged just over 90, but it is premature to draw any conclusions about trends in the data.

### Agriculture

Queensland has offered a subject entitled Agriculture and Animal Production since 1980. As can be seen from Table 10, the enrolments have shown some growth from 1980 to 1985 with males constituting approximately 70% of the enrolment. Since 1983 the ACT has offered the subject Agriculture but the numbers have declined by approximately 50% in the last two years.

## TABLE 8:

### General science enrolment statistics in Queensland, New South Wales and the ACT

| Year | Male | Female | Total |
|---|---|---|---|
| QUEENSLAND | | | |
| 1980 | 363 | 264 | 627 |
| 1981 | 451 | 261 | 712 |
| 1982 | 445 | 317 | 762 |
| 1983 | 671 | 399 | 1070 |
| 1984 | 770 | 578 | 1348 |
| 1985 | 1045 | 721 | 1766 |
| NEW SOUTH WALES | | | |
| 1981 | 1206 | 1404 | 2610 |
| 1982 | 1046 | 1288 | 2334 |
| 1983 | 1309 | 1609 | 2918 |
| 1984 | 1874 | 2050 | 3924 |
| 1985 | 2051 | 2083 | 4134 |
| ACT | | | |
| General Science | | | |
| 1983 | 51 | 32 | 83 |
| 1984 | 48 | 27 | 75 |
| 1985 | 13 | 3 | 16 |
| Multidisciplinary | | | |
| 1982 | 168 | 188 | 356 |
| 1983 | Nil | 39 | 39 |
| 1984 | Nil | 28 | 28 |
| 1985 | 10 | 13 | 23 |

## TABLE 9:

### Environmental studies enrolment statistics in Tasmania, Victoria and the ACT

| Year | Male | Female | Total |
|---|---|---|---|
| TASMANIA | | | |
| 1980 | — | — | 170 |
| 1981 | 58 | 76 | 134 |
| 1982 | 50 | 63 | 113 |
| 1983 | 54 | 43 | 97 |
| 1984 | 48 | 20 | 68 |
| 1985 | 73 | 46 | 119 |
| VICTORIA | | | |
| 1983 | 225 | 270 | 495 |
| 1984 | 221 | 214 | 435 |
| 1985 | 257 | 223 | 480 |
| ACT | | | |
| 1983 | 39 | 68 | 107 |
| 1984 | 46 | 57 | 103 |
| 1985 | 32 | 36 | 68 |

 42 b

## TABLE 10:

**Agriculture enrolment statistics in Queensland and the ACT**

| Year | Male | Female | Total |
|---|---|---|---|
| QUEENSLAND | | | |
| 1980 | 174 | 66 | 240 |
| 1981 | 225 | 83 | 308 |
| 1982 | 204 | 96 | 300 |
| 1983 | 194 | 105 | 299 |
| 1984 | 257 | 119 | 376 |
| 1985 | 282 | 123 | 405 |
| ACT | | | |
| 1982 | 53 | 41 | 94 |
| 1983 | 34 | 65 | 99 |
| 1984 | 24 | 26 | 50 |
| 1985 | 24 | 26 | 50 |

## TABLE 11:

**Optional science subjects enrolments units in the ACT**

| Subject | Male | Female | Total |
|---|---|---|---|
| **Applied Science** | | | |
| 1984 | 9 | Nil | 9 |
| 1985 | 15 | Nil | 15 |
| **Astronomy** | | | |
| 1983 | 10 | 2 | 12 |
| 1984 | 7 | 2 | 9 |
| 1985 | 10 | 2 | 12 |
| **Electronics** | | | |
| 1983 | 74 | Nil | 74 |
| 1984 | 88 | 2 | 90 |
| 1985 | 57 | 1 | 58 |
| **Food Studies** | | | |
| 1983 | 35 | 110 | 145 |
| 1984 | 24 | 108 | 132 |
| 1985 | 29 | 113 | 142 |
| **Oceanography** | | | |
| 1983 | 12 | 7 | 19 |
| 1984 | 11 | 6 | 17 |
| 1985 | 12 | 4 | 16 |
| **Photography** | | | |
| 1983 | 41 | 63 | 104 |
| 1984 | 68 | 69 | 137 |
| 1985 | 70 | 71 | 141 |
| **Science-Health** | | | |
| 1983 | Nil | 60 | 60 |
| 1984 | Nil | 80 | 80 |
| 1985 | N/A | N/A | N/A |
| **Technology** | | | |
| 1983 | 99 | 8 | 107 |
| 1984 | 111 | 6 | 117 |
| 1985 | 127 | 9 | 136 |

### Options in the ACT

The Australian Capital Territory is in many ways the leader in secondary education in Australia. In terms of its ability to retain young people to Year 12, the ACT's retentivity of 77.7% in 1985 is by far the highest in the nation compared to the national retentivity of 46.3% in the same year. Furthermore, a flexible policy enables Year 12 students to choose from a wide range of optional subjects in addition to Biology, Chemistry, Geology and Physics. These include General Biology, Human Biology, Web of Life, Physical Science and Earth Science, all of which have been included in the statistical data presented earlier. In addition, the ACT offers subjects such as Multidisciplinary Science, General Science, Environmental Studies and Agriculture, which have been discussed previously in this chapter.

Table 11 lists eight optional units, seven of which have been offered since 1983, whilst the eighth - Applied Science - has only been offered since 1984. Some of these subjects, such as Applied Science, Astronomy and Oceanography, have very small enrolments, but others like Electronics, Food Studies, Photography, Science - Health and Technology, have quite significant enrolments when the total Year 12 population in the ACT is taken into account. Two of these subjects - Electronics and Technology - are male-dominated, whereas Science-Health, and to a lesser extent, Food Studies, are predominently studied by females.

## 2.4 MATHEMATICS

The format of the discussion of mathematics enrolment statistics which follows differs considerably from that adopted for the preceding section in science. This is because the degree of difficulty of the various types of mathematics courses available in each State adds an extra dimension beyond that which is required to describe the science subjects. A discussion relating to male and female statistics is followed first by an examination of the types of courses available and then by the course statistics.

### Male and Female Statistics

Mathematics enrolment statistics for each State in Australia are displayed in Table 12. The national enrolment figures for mathematics students in Year 12 from 1976-1985 are shown in Figure 12. Over the period 1976-1982 the Peer-Year-12 population was approximately constant since the greater retentivity of females was balanced by a declining retentivity of males. However, since 1982 there has been dramatic growth reflecting the enhanced male and female retentivity over the same time period. The variation of mathematics Year 12 enrolments over the same period is also shown in Figure 12. The numbers have demonstrated a steady growth over this period, from 73,146 in 1976 to 101,585 in 1985. It is interesting to note the similarity of the curves in Figure 12. Mathematics enrolments over the last ten years have consistently "paralleled" the Peer-Year-12 population figures - that is, numbers have kept pace with the relative increase in the Year 12 enrolments.

Since the Year 8 population is four years ahead of the corresponding Year 12 population, it is apparent that the growth for 1981-1985 will 'flow on' to Year 12 from 1985-1989. The larger age cohort, coupled with the trends in retentivity described above, will have a significant impact on the number of students entering Year 12 in the immediate future, and presumably those wishing to enter tertiary institutions a year later. Acknowledging the increase in the number of students studying mathematics at the senior school level over the past decade, it will be interesting to observe the proportion of the enhanced Year 12 population opting for the subject in future years.

Figure 13 depicts the statistical data in Table 12 in schematic form on a State-by-State basis. Of all the States, Queensland has shown the greatest increase in student numbers over the 1970-1985 period. Since 1975 the enrolments have increased from 11,083 to 25,577 in 1985. This represents an approximate two-fold increase in male enrolments and a three-fold increase in female enrolments. The Queensland enrolments as a proportion of the Parent-Year-8 population have exceeded the base year since 1975, while the Peer-Year-12 proportion remained around unity until it finally exceeded the base year figure in 1981. In view of the massive increase in retentivity (29.4% to over 55% from 1970 to 1985), these proportions reflect the popularity of mathematics in the State. A new subject, Mathematics in Society, introduced into Queensland in 1983, attracted 6,[illegible]6 enrolments in its first year of operation and 4,146 enrolments in 1985. Though it is too early to comment on its influence in the Queensland context, this enormous jump in enrolments suggests that this subject may play a major role in attracting a new clientele without undercutting enrolments in the other mathematics units available in the State.

New South Wales has the largest number of students studying mathematics, but the data are only listed in Table 12 from 1976 because in that year the pattern of secondary education in that State changed. The proportion of mathematics Year 12 enrolments with respect to the Peer-Year-12 population has remained close to unity for the period, as it has with respect to the Parent-Year-8 population, while the actual numbers have fluctuated up and down over the period, finally reflecting a steady growth due to the increase in the enrolment of females studying the subject. Female numbers have increased by approximately 30% over the 9-year period while the number of males has remained relatively constant.

# Table 12:

## Mathematics Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Mathematics Enrolments Male | Year 12 Mathematics Enrolments Female | Total‡ | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| QUEENSLAND | | | | | | | | |
| 1966 | 32021 | | | | | | | |
| 1967 | 32242 | | | | | | | |
| 1968 | 33127 | | | | | | | |
| 1969 | 34043 | | | | | | | |
| 1970 | 34679 | 9407 | 29.4 | | | 10505 | 1.000 | 1.000 |
| 1971 | 35355 | 9883 | 30.7 | | | 10589 | 0.959 | 1.002 |
| 1972 | 36999 | 10770 | 32.5 | | | 11489 | 0.955 | 1.057 |
| 1973 | 37742 | 10973 | 32.2 | 7888 | 3560 | 11448 | 0.934 | 0.916 |
| 1974 | 39595 | 11368 | 32.8 | 7849 | 3653 | 11502 | 0.906 | 1.010 |
| 1975 | 39805 | 11586 | 32.8 | 7451 | 3632 | 11083 | 0.857 | 0.955 |
| 1976 | 39493 | 12920 | 34.9 | 8326 | 3935 | 12261 | 0.850 | 1.010 |
| 1977 | 38780 | 13871 | 36.8 | 8895 | 4819 | 13714 | 0.885 | 1.107 |
| 1978 | 37962 | 14818 | 37.1 | 9361 | 5675 | 15036 | 0.909 | 1.157 |
| 1979 | 37696 | 14995 | 37.7 | 9389 | 6540 | 15929 | 0.951 | 1.220 |
| 1980 | 39319 | 15251 | 38.6 | 9668 | 7232 | 16900 | 0.992 | 1.304 |
| 1981 | 41149 | 15016 | 38.7 | 9547 | 7650 | 17197 | 1.026 | 1.352 |
| 1982 | 43800 | 15996 | 42.1 | 9954 | 8399 | 18353 | 1.027 | 1.474 |
| 1983 | 45672 | 17810 | 47.2 | 11139 | 9371 | 20510 | 1.031 | 1.658 |
| 1984 | 48007 | 20865 | 53.1 | 12690 | 10935 | 23625 | 1.014 | 1.832 |
| 1985 | 47338 | 22668 | 55.1 | 13759 | 11818 | 25577 | 1.010 | 1.895 |
| NEW SOUTH WALES | | | | | | | | |
| 1966 | 75233 | | | | | | | |
| 1967 | 76421 | | | | | | | |
| 1968 | 77983 | | | | | | | |
| 1969 | 79161 | | | | | | | |
| 1970 | 80421 | 23805 | 31.6 | | | | | |
| 1971 | 82712 | 24822 | 32.5 | | | | | |
| 1972 | 83534 | 26564 | 34.1 | | | | | |
| 1973 | 84807 | 27061 | 34.2 | | | | | |
| 1974 | 86619 | 26837 | 33.4 | | | | | |
| 1975 | 88735 | 28014 | 33.9 | | | | | |
| 1976 | 87605 | 29222 | 35.0 | 15923 | 12854 | 28777 | 1.000 | 1.000 |
| 1977 | 86289 | 30652 | 36.1 | 15273 | 13481 | 28754 | 0.953 | 0.886 |
| 1978 | 83230 | 31276 | 36.1 | 15433 | 14351 | 29784 | 0.967 | 0.899 |
| 1979 | 81995 | 30927 | 34.9 | 14881 | 14605 | 29486 | 0.968 | 0.869 |
| 1980 | 81891 | 28881 | 33.0 | 13680 | 13772 | 27452 | 0.965 | 0.819 |
| 1981 | 82439 | 28411 | 32.9 | 13322 | 13438 | 26760 | 0.957 | 0.811 |
| 1982 | 85509 | 28075 | 33.7 | 12952 | 13738 | 27690 | 1.002 | 0.870 |
| 1983 | 86881 | 30712 | 37.5 | 14586 | 14898 | 29484 | 0.975 | 0.940 |
| 1984 | 92284 | 33784 | 41.3 | 16157 | 16120 | 32277 | 0.970 | 1.030 |
| 1985 | 94397 | 34261 | 41.6 | 16227 | 16692 | 32919 | 0.976 | 1.044 |
| AUSTRALIAN CAPITAL TERRITORY | | | | | | | | |
| 1973 | 3211 | | | | | | | |
| 1974 | 3469 | | | | | | | |
| 1975 | 3824 | | | | | | | |
| 1976 | 3877 | | | | | | | |
| 1977 | 3978 | 2136 | 66.5 | 898 | 813 | 1711 | 1.000 | 1.000 |
| 1978 | 3858 | 2317 | 66.8 | 1088 | 913 | 2001 | 1.078 | 1.083 |
| 1979 | 4002 | 2578 | 67.4 | 1162 | 1161 | 2323 | 1.125 | 1.140 |
| 1980 | 3976 | 2538 | 65.5 | 1178 | 1191 | 2369 | 1.165 | 1.147 |
| 1981 | 4056 | 2675 | 67.2 | 1234 | 1347 | 2581 | 1.205 | 1.218 |
| 1982 | 4248 | 2720 | 70.5 | 1220 | 1319 | 2539 | 1.165 | 1.235 |
| 1983 | 4651 | 2918 | 72.9 | 1320 | 1383 | 2703 | 1.156 | 1.268 |
| 1984 | 5065 | 3145 | 79.1 | 1483 | 1463 | 2946 | 1.1[illegible]9 | 1.391 |
| 1985 | 5107 | 3150 | 77.7 | 1459 | 1530 | 2989 | 1.185 | 1.383 |

## Table 12: (contd)

### Mathematics Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Mathematics Enrolments Male | Female | Totals | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| VICTORIA | | | | | | | | |
| 1966 | 60154 | | | | | | | |
| 1967 | 59858 | | | | | | | |
| 1968 | 61490 | | | | | | | |
| 1969 | 62762 | | | | | | | |
| 1970 | 63801 | 18915 | 31.4 | 10227 | 3841 | 14068 | 1.000 | 1.000 |
| 1971 | 65185 | 19221 | 32.1 | 10279 | 4023 | 14302 | 1.000 | 1.022 |
| 1972 | 66938 | 20367 | 33.1 | 9754 | 4394 | 14148 | 0.934 | 0.984 |
| 1973 | 67267 | 21416 | 34.1 | 9921 | 4596 | 14517 | 0.911 | 0.989 |
| 1974 | 69520 | 21465 | 33.6 | 9632 | 4780 | 14412 | 0.903 | 0.966 |
| 1975 | 69672 | 22930 | 35.2 | 9539 | 5208 | 14747 | 0.865 | 0.967 |
| 1976 | 69052 | 23580 | 35.2 | 9360 | 5353 | 14713 | 0.839 | 0.940 |
| 1977 | 68034 | 22884 | 34.0 | 9322 | 5467 | 14789 | 0.869 | 0.931 |
| 1978 | 66932 | 23046 | 33.1 | 9428 | 5808 | 15236 | 0.896 | 0.937 |
| 1979 | 65684 | 22528 | 32.3 | 9323 | 5964 | 15287 | 0.912 | 0.938 |
| 1980 | 67019 | 22580 | 32.7 | 9194 | 6118 | 15312 | 0.912 | 0.948 |
| 1981 | 67866 | 22573 | 33.2 | 9351 | 6260 | 15611 | 0.930 | 0.981 |
| 1982 | 71461 | 23050 | 34.4 | 9339 | 6592 | 15931 | 0.929 | 1.018 |
| 1983 | 71048 | 25385 | 38.7 | 9741 | 6966 | 16707 | 0.885 | 1.088 |
| 1984 | 74594 | 28971 | 43.2 | 10396 | 7557 | 17953 | 0.833 | 1.145 |
| 1985 | 73092 | 30706 | 45.2 | 10530 | 7568 | 18098 | 0.792 | 1.140 |
| TASMANIA | | | | | | | | |
| 1966 | 7890 | | | | | | | |
| 1967 | 7746 | | | | | | | |
| 1968 | 7762 | | | | | | | |
| 1969 | 8352 | | | | | | | |
| 1970 | 8162 | 1358 | 17.2 | | | 1473 | 1.000 | 1.000 |
| 1971 | 8112 | 1581 | 20.4 | | | 1601 | 0.934 | 1.107 |
| 1972 | 8148 | 1787 | 23.0 | 1175 | 501 | 1676 | 0.865 | 1.156 |
| 1973 | 8205 | 1966 | 23.5 | 1135 | 452 | 1587 | 0.744 | 1.018 |
| 1974 | 8532 | 1864 | 22.8 | 1070 | 453 | 1523 | 0.753 | 0.999 |
| 1975 | 8555 | 2086 | 25.7 | 972 | 433 | 1405 | 0.621 | 0.927 |
| 1976 | 8228 | 2079 | 25.5 | 942 | 357 | 1299 | 0.576 | 0.854 |
| 1977 | 8238 | 3113 | 25.8 | 936 | 374 | 1310 | 0.572 | 0.855 |
| 1978 | 7797 | 2099 | 24.6 | 834 | 402 | 1236 | 0.543 | 0.776 |
| 1979 | 7409 | 2215 | 25.9 | 816 | 426 | 1242 | 0.517 | 0.778 |
| 1980 | 7344 | 2237 | 27.2 | 790 | 444 | 1234 | 0.509 | 0.803 |
| 1981 | 7358 | 2203 | 26.7 | 881 | 455 | 1336 | 0.559 | 0.869 |
| 1982 | 7914 | 1716 | 22.0 | 833 | 478 | 1311 | 0.704 | 0.901 |
| 1983 | 7939 | 1845 | 24.9 | 958 | 482 | 1440 | 0.724 | 1.041 |
| 1984 | 8212 | 2033 | 27.7 | 937 | 498 | 1435 | 0.651 | 1.047 |
| 1985 | 8072 | 2126 | 28.9 | 913 | 515 | 1428 | 0.619 | 1.040 |

## Table 12: (contd)

### Mathematics Enrolment Statistics in Australia

| Year | Parent Year 8 Population | Peer Year 12 Population | Retentivity % | Year 12 Mathematics Enrolments Male | Year 12 Mathematics Enrolments Female | Total‡ | *Peer Year 12 Proportion | **Parent Year 8 Proportion |
|---|---|---|---|---|---|---|---|---|
| **SOUTH AUSTRALIA** | | | | | | | | |
| 1966 | 22566 | | | | | | | |
| 1967 | 22965 | | | | | | | |
| 1968 | 23081 | | | | | | | |
| 1969 | 23448 | | | | | | | |
| 1970 | 23911 | 5972 | 26.5 | | | 8355 | 1.000 | 1.000 |
| 1971 | 24040 | 6836 | 29.8 | | | 8356 | 0.874 | 0.983 |
| 1972 | 24545 | 7468 | 32.4 | | | 8460 | 0.810 | 0.989 |
| 1973 | 25418 | 7730 | 33.0 | 5615 | 2435 | 8050 | 0.748 | 0.927 |
| 1974 | 25527 | 7758 | 32.4 | 5062 | 2230 | 7292 | 0.672 | 0.824 |
| 1975 | 25366 | 8670 | 36.1 | 4830 | 2155 | 6985 | 0.576 | 0.785 |
| 1976 | 24592 | 9093 | 37.0 | 4667 | 2279 | 6946 | 0.573 | 0.764 |
| 1977 | 23902 | 9066 | 35.7 | 4502 | 2399 | 6901 | 0.542 | 0.733 |
| 1978 | 23364 | 9124 | 35.7 | 4408 | 2542 | 6950 | 0.545 | 0.735 |
| 1979 | 22390 | 9356 | 36.9 | 4536 | 2654 | 7190 | 0.549 | 0.766 |
| 1980 | 22115 | 9535 | 38.8 | 4652 | 2707 | 7359 | 0.552 | 0.808 |
| 1981 | 22893 | 9308 | 38.9 | 4453 | 2775 | 7228 | 0.555 | 0.817 |
| 1982 | 23695 | 9580 | 41.0 | 4616 | 3092 | 7708 | 0.575 | 0.891 |
| 1983 | 23851 | 10655 | 47.6 | 4912 | 3283 | 8195 | 0.550 | 0.989 |
| 1984 | 23483 | 11087 | 50.1 | 4797 | 3215 | 8012 | 0.517 | 0.979 |
| 1985 | 22658 | 11711 | 51.2 | 4678 | 3176 | 7854 | 0.479 | 0.927 |
| **WESTERN AUSTRALIA** | | | | | | | | |
| 1966 | 17411 | | | | | | | |
| 1967 | 17637 | | | | | | | |
| 1968 | 19059 | | | | | | | |
| 1969 | 19333 | | | | | | | |
| 1970 | 20064 | 4680 | 26.9 | 4985 | 2014 | 6999 | 1.000 | 1.000 |
| 1971 | 20145 | 4866 | 27.6 | 5041 | 2209 | 7250 | 0.996 | 1.023 |
| 1972 | 20642 | 5648 | 29.6 | 5458 | 2491 | 7949 | 0.941 | 1.037 |
| 1973 | 21202 | 6121 | 31.7 | 5562 | 2670 | 8232 | 0.900 | 1.059 |
| 1974 | 22028 | 6581 | 32.8 | 5514 | 2976 | 8490 | 0.863 | 1.053 |
| 1975 | 22414 | 6870 | 34.1 | 5239 | 3490 | 8729 | 0.850 | 1.078 |
| 1976 | 22665 | 7380 | 35.7 | 5431 | 3719 | 9150 | 0.829 | 1.102 |
| 1977 | 22371 | 7416 | 35.0 | 5221 | 4000 | 9221 | 0.831 | 1.082 |
| 1978 | 21861 | 7543 | 34.2 | 4972 | 4091 | 9063 | 0.803 | 1.023 |
| 1979 | 22198 | 7631 | 34.0 | 5097 | 4157 | 9254 | 0.811 | 1.027 |
| 1980 | 22110 | 7700 | 34.0 | 5134 | 4370 | 9504 | 0.825 | 1.043 |
| 1981 | 23262 | 7843 | 35.1 | 5160 | 4462 | 9622 | 0.820 | 1.070 |
| 1982 | 24213 | 8184 | 37.4 | 5151 | 4445 | 9596 | 0.784 | 1.092 |
| 1983 | 25014 | 8970 | 40.4 | 5830 | 4961 | 10791 | 0.804 | 1.209 |
| 1984 | 26126 | 10090 | 45.6 | 6337 | 5420 | 11757 | 0.779 | 1.323 |
| 1985 | 25138 | 11059 | 47.5 | 6878 | 5842 | 12720 | 0.770 | 1.360 |

‡ These totals may exceed the corresponding figures in the Peer-Year-12 Population column because some students are enrolled in more than one mathematics unit (e g , in concurrent units Mathematics II, III in Western Australia)

* Peer-Year-12 Proportion in 198X =

$$\frac{\text{Year 12 Maths Enrolment in 198X}}{\text{Year 12 Maths Enrolment in base year}} \times \frac{\text{Peer Year 12 Population in base year}}{\text{Peer Year 12 Population 198X}}$$

** Parent-Year-8 Proportion 198X =

$$\frac{\text{Year 12 Maths Enrolment in 198X}}{\text{Year 12 Maths Enrolment in base year}} \times \frac{\text{Parent Year 8 Population in base year}}{\text{Parent Year 8 Population 198(X-4)}}$$

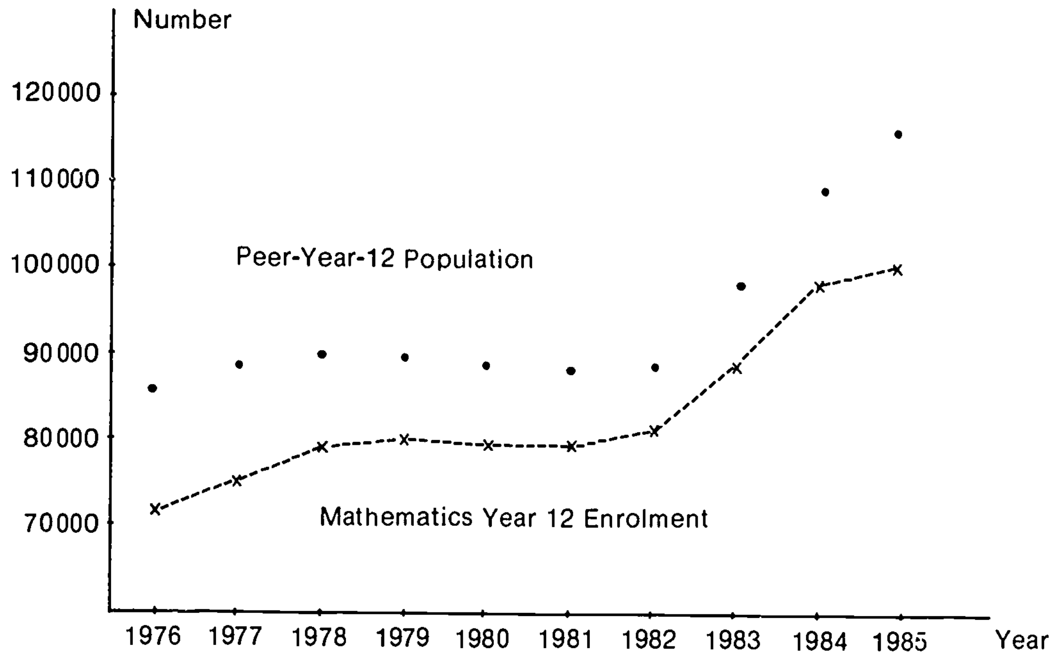


Figure 12 National trends for students taking Mathematics as a Public Examinations subject as compared to the Peer-Year-12 population over the period 1976-1985

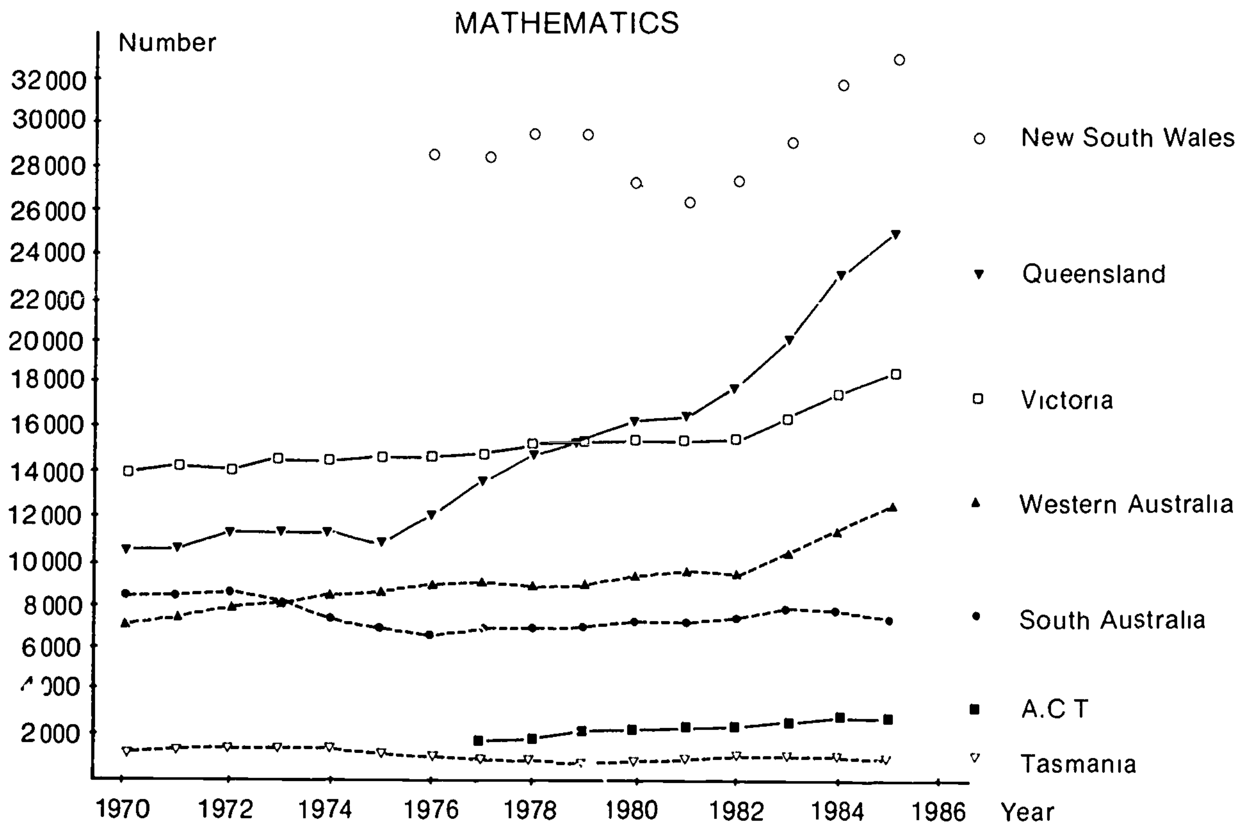


Figure 13 The number of students taking mathematics as a Public Examinations subject from 1970-1985 (Victoria, Queensland, South Australia, Western Australia and Tasmania), from 1976-1985 (New South Wales) and from 1977-1985 (ACT)

The statistics for the Australian Capital Territory require some explanation. Prior to 1977, students in the ACT took the NSW Higher School Certificate and it proved impossible to extract the ACT data from the total NSW figures. However, the data for the ACT from 1977-1985 are listed in Table 12 and displayed in Figure 13. The data show a steady increase in mathematics numbers from 1977-1985, with male and female enrolments increasing at a similar rate. The proportion of mathematics enrolments to the Parent-Year-8 and the Peer-Year-12 populations exceed unity for each year of the period and thus represent the healthiest situation of all the states. It should also be noted that the ACT retentivity of over 77.7% in 1985 was the highest in the nation.

The Victorian enrolments have demonstrated what appears to be a steady, if unspectacular, increase over the 1970-1985 period (Table 12). The proportion of the Peer-Year-12 population studying mathematics has, however, declined to 79% compared with the situation in 1970, and male enrolments actually dropped to a low of 9,194 in 1980. As with the States already mentioned, the overall increase in mathematics enrolments in Victoria can be attributed to increased participation by females - close to a 100% increase from 1970 to 1985. A new computing option within the unit General Mathematics, introduced in 1976, has undoubtedly contributed to this increase. The proportion of mathematics Year 12 enrolments with respect to the Parent-Year-8 population has exceeded the base year since 1982, although it has hovered close to unity throughout the 1970-1985 period.

The Tasmanian enrolment in 1985 was not too dissimilar to that in 1970, although a steady decline in numbers was in evidence over the period 1972-1980. The decline has been caused primarily by a drop in male enrolments. The proportion of mathematics students with respect to the Parent-Year-8 population dropped below unity in 1974 before recovering in 1983. With respect to the Peer-Year-12 population, the proportion declined to 51% of the 1970 base year in 1980 but has subsequently recovered. The retentivity in Tasmania is by far the lowest in the nation, with 28.9% of the students remaining to Year 12 in 1985.

In South Australia there has been a steady decline in enrolments from 1970. This decline can be attributed to a 17% drop in male enrolments since 1973, although there has been a corresponding 30% increase in female enrolments over this period of time. Since the retentivity from Year 8 to Year 12 in South Australia has increased from 26.5% in 1970 to 51.2% in 1985, it is apparent that the proportion of students studying mathematics compared to the Peer-Year-12 population must have declined. In fact in 1985, the proportion was less than 50% of the 1970 base year. With respect to the Parent-Year-8 population the situation is slightly better, for despite the fact that throughout most of the period the proportion was less than the base year, it has approached unity since 1983.

The Western Australian enrolments have demonstrated steady growth over the 16-year time span. Again, this has been caused by an increase in the number of females opting to study the subject (190% over the period). It is disappointing to note that the number of males has not experienced a corresponding increase, though the 38% increase for males over 1970-1985 may be regarded as an encouraging trend which has become apparent since the low point of male enrolments in 1978. Despite the overall increase in numbers studying mathematics, their proportion of the Peer-Year-12 population has declined to 77% compared with the situation in 1970, due to an increase in retentivity (from 26.9% to over 47.5%). With respect to the proportion of the Parent-Year-8 population, the Western Australian enrolments have barely exceeded the base year figure throughout the 1970-1985 period, remaining relatively constant until 1983 when a significant increase over the 1970 base year became evident. The steady increase in the gross figures for Western Australia since 1974 hide an interesting redistribution of enrolments over the various mathematics units available in the State, due probably to the introduction of a new subject, Mathematics IV, in that year. The availability of this unit caused a drop in the number of males selecting the more rigorous double unit Mathematics II/III, the enrolments in which reached a low in 1981 before gradually improving.

### Course Statistics:

Since the mid-1960's there has been a shift in the range and function of mathematics courses offered in each State at the Year 11 and 12 levels. Rosier (1980) analysed the different courses available in Australia and identified three basic types:

*Type 1* courses are described as "terminal" mathematics courses. They are not designed to provide a foundation for any future tertiary studies involving mathematics.

*Type 2* courses involve a level of "mathematical competence" which provide a satisfactory background for tertiary studies in which the mathematics content is minimal - for example, in architecture, pharmacy or economics.

*Type 3* courses involve "specialised mathematics" leading to tertiary studies in which mathematics is an integral part of the discipline, as in mathematics, physical science or engineering.

Table 13 classifies the three types of course in each State and the Australian Capital Territory.

## TABLE 13:

### Range and Function of Year 12 Mathemat ourses — Course Type[1]

| State | Type 1 | Type 2 | Type 3 |
|---|---|---|---|
| QLD | Social Mathematics | Mathematics I | Mathematics I — Mathematics II |
| NSW | Two unit (2A) Mathematics | Two unit mathematics | Three unit mathematics<br>Four unit mathematics |
| ACT | Minor Mathematics | Major Mathematics<br>Major/Minor Mathematics | Double major mathematics |
| VIC | General Mathematics | General Mathematics | Applied Mathematics<br>Pure Mathematics [2] |
| TAS | Mathematics Level II | Mathematics Level III | Analysis and Statistics. Level III<br>Algebra and Geometry. Level III |
| SA[3] | Mathematics IS | Mathematics IS | Mathematics 1 Mathematics 2[4] |
| NT[3] | Mathematics IS | Mathematics IS | Mathematics 1 Mathematics 2[4] |
| WA | Mathematics IV | Mathematics I | Mathematics II Mathematics III[4] |

1 Type 1: Terminal units — no expectation of further mathematics
Type 2: Some non-specialised mathematics expected
Type 3: Further specialised mathematics expected

2 Corequisite units

3 Identical courses

4 Units usually studied concurrently.

## TABLE 14:

### Enrolment Statistics for Mathematics Courses in Australia

| Year | Queensland | | | New South Wales | | | | A.C.T.** | | | Victoria | | | Tasmania | | | South Australia | | | Western Australia | | | | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Type 1 | Type 2 | Type 3 | Type 1 | Type 2 | Type 3 | | Type 1 | Type 2 | Type 3 | Type 1/2 | Type 3 | | Type 1 | Type 2 | Type 3 | Type 1/2 | Type 3 | | Type 1 | Type 2 | Type 3 | | |
| | Social | I | II | 2UA | 2U | 3U | 4U | Ma 3 | Ma 2 | Ma 1 | General* | Pure | Applied | Maths | Alg + Ge | An + St | 1S | 1 | 2 | IV | I | II | III | |
| 1970 | 357 | 6425 | 3723 | — | — | — | — | — | — | — | 3903 | 5215 | 4950 | — | — | — | 1062 | 3657 | 3636 | — | 2458 | 2374 | 2167 | 1970 |
| 1971 | 287 | 6659 | 3643 | — | — | — | — | — | — | — | 4288 | 5151 | 4863 | — | | — | 1536 | 3413 | 3407 | — | 2839 | 2252 | 2159 | 1971 |
| 1972 | 305 | 7138 | 4046 | — | — | — | — | — | — | — | 4578 | 4989 | 4581 | — | — | — | 2107 | 3184 | 3169 | | 3465 | 2276 | 2208 | 1972 |
| 1973 | 306 | 7554 | 3588 | — | — | — | — | — | — | — | 5366 | 4761 | 4390 | — | — | | 2571 | 2749 | 2730 | | 3866 | 2212 | 2154 | 1973 |
| 1974 | 325 | 7711 | 3466 | — | — | — | — | — | — | — | 5777 | 4497 | 4178 | 230 | — | 6 | 2749 | 2277 | 2266 | 599 | 3686 | 2124 | 2081 | 1974 |
| 1975 | 416 | 7462 | 3205 | — | — | — | — | — | — | — | 6338 | 4380 | 4029 | 648 | 78 | 137 | 2829 | 2080 | 2076 | 1283 | 3798 | 1831 | 1820 | 1975 |
| 1976 | 917 | 8186 | 3158 | 7927 | 13604 | 6187 | 1089 | — | — | — | 6629 | 4233 | 3851 | 744 | 115 | 174 | 2959 | 1997 | 1990 | 1622 | 3943 | 1797 | 1788 | 1976 |
| 1977 | 2553 | 7926 | 3235 | 8513 | 14356 | 5314 | 571 | — | — | — | 6733 | 4205 | 3851 | 933 | 95 | 161 | 2886 | 2011 | 2004 | 1724 | 3849 | 1829 | 1819 | 1977 |
| 1978 | 3287 | 8326 | 3423 | 8824 | 15177 | 5199 | 584 | — | — | — | 7366 | 4096 | 3774 | 976 | 76 | 184 | 2653 | 2152 | 2148 | 1524 | 4072 | 1737 | 1730 | 1978 |
| 1979 | 4101 | 8403 | 3425 | 8237 | 14889 | 5658 | 702 | — | — | — | 7517 | 4053 | 3717 | 1040 | 61 | 141 | 2677 | 2257 | 2256 | 1606 | 4135 | 1758 | 1755 | 1979 |
| 1980 | 4760 | 8553 | 3587 | 7092 | 13882 | 5695 | 783 | — | — | — | 7542 | 4041 | 3729 | 1005 | 63 | 166 | 2707 | 2329 | 2323 | 1741 | 4346 | 1713 | 1704 | 1980 |
| 1981 | 5243 | 8177 | 3480 | 6866 | 13578 | 5425 | 891 | — | — | — | 7552 | 4239 | 3820 | 1071 | 101 | 164 | 2369 | 2434 | 2425 | 1859 | 4377 | 1701 | 1685 | 1981 |
| 1982 | 5944 | 8734 | 3675 | 6709 | [illegible] | 5130 | 1000 | 525 | 706 | 1081 | 7168 | 4680 | 4083 | 1051 | 87 | 173 | 2560 | 2576 | 2572 | 1878 | 4173 | 1773 | 1772 | 1982 |
| 1983 | 7053† | 9449 | 4008 | 7836 | 14620 | 5766 | 1262 | 552 | 927 | 1224 | 7380 | 4970 | 4357 | 1135 | 68 | 237 | 2932 | 2631 | 2652 | 2214 | 4701 | 1940 | 1936 | 1983 |
| 1984 | 8653† | 10669 | 4303 | 9474 | 15011 | 6435 | 1357 | 632 | 954 | 1360 | 8246 | 5206 | 4501 | 1152 | 77 | 206 | 2972 | 2520 | 2520 | 2629 | 5107 | 2010 | 2011 | 1984 |
| 1985 | 9656† | 11324 | 4597 | 10057 | 14538 | 6682 | 1642 | 626 | 1005 | 1358 | 8911 | 4918 | 4269 | 1164 | 98 | 166 | 3014 | 2425 | 2415 | 2838 | 5763 | 2061 | 2088 | 1985 |

* Includes Computing Option enrolment from 1976

** No breakdown by course type available prior to 1982

† Includes students enrolled in Mathematics in Society

Type 1 Terminal Units — no expectation of further mathematics

Type 2 Some non-specialised mathematics expected

Type 3 Further specialised mathematics expected

Unfortunately this classification of courses is not without overlaps and ambiguities. It is well known, for example, that Mathematics 1 in Western Australia (formerly called General Mathematics) was originally introduced to serve a dual purpose encompassed by the *Type 1* and *Type 2* courses described earlier. It was only with the introduction of Mathematics IV in Western Australia in 1974 that Mathematics I could unambiguously be described as a *Type 2* course. Also, it is to be noted from Table 13 that the General Mathematics course in Victoria is currently serving a dual purpose, and in South Australia the Mathematics IS program which is principally a *Type 1* course, is also listed as a *Type 2* course because it serves that function for tertiary institutions in that State.

## The National Scene

It is not possible to present complete male/female enrolment statistics from 1970 in each State in Table 14. Tasmania experienced a phasing-in of new mathematics courses over the four-year period commencing 1974; consequently the early statistics for Tasmania are limited and fragmented. The Queensland, Victorian, South Australian, and Western Australian educational authorities were able to provide complete data for the period 1970-1985, though in the case of the latter State, data for the Type 1 course commences with its introduction in 1974. Data for New South Wales were available from 1976 only, and that for the ACT from 1982.

Figure 14 has been compiled by simply summarising the total enrolments in each type of course as presented in Table 14. Its interpretation is subject to the limitations just described and to the problems of overlap in course types mentioned earlier. Figure 14 does, however, depict trends which constitute, at the very least, order of magnitude guides where formerly there has been rather more speculation than quantification. The two most significant features in Figure 14 are the early establishment of the popularity of the *Type 1* and 2 courses overall, and the relative stability of the *Type 3* course compared to the other two types.

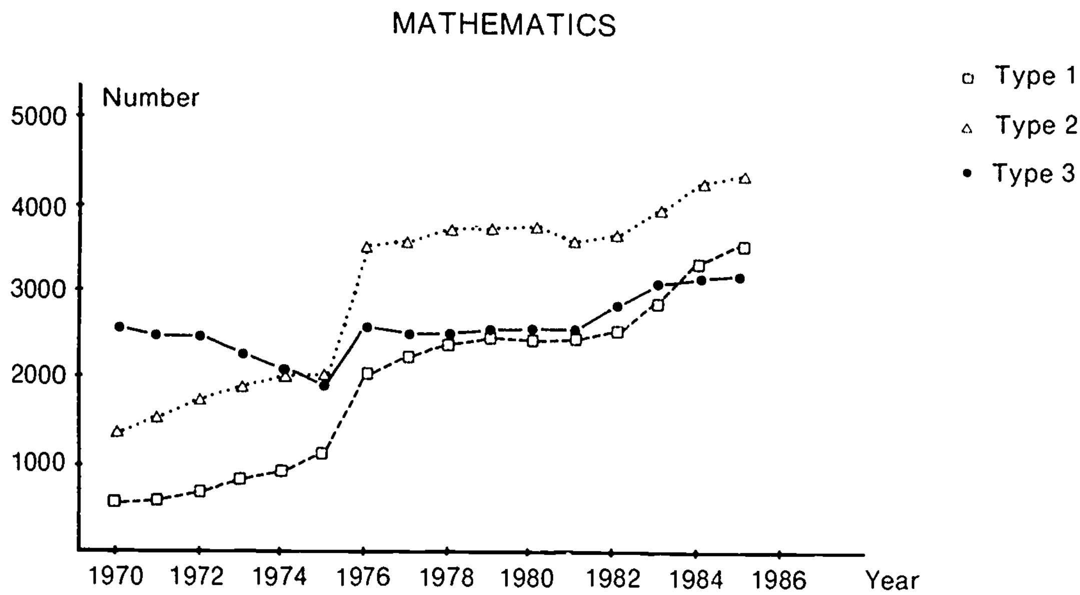


Figure 14 National Year 12 enrolments for (a) terminal mathematics courses (Type 1), (b) courses providing background for tertiary studies (Type 2), and courses for tertiary studies in which mathematics is an integral part of the discipline (Type 3)

## Course Enrolment Patterns in the States

In Queensland the most dramatic change in enrolments has been in the Type 1 course which peaked in 1985 with a 27-fold increase in absolute enrolments over the 1970 figure (*Table 14*). The substantial increase in female mathematics enrolments since 1973 relative to the base year is also evident (*Table 15*). The *Type 2* course shows a 76% increase in absolute enrolments since 1970, while the *Type 3* course enrolments have remained fairly constant with some increase over 1983-85. The *Type 1* Social Mathematics course increase appears to be due to the influx of students who previously took no Senior School Certificate courses in mathematics - an encouraging development. Relative to the Peer- Year-12 population, decreases in both *Type 2* and *Type 3* course enrolments are evident for both sexes (Table 15). A consideration of the male/female ratio in Table 16 demonstrates the near triple enrolment of males to females in the *Type 3* course, while in the *Type 1* course females outnumber males five to three. In the Type 2 course this ratio has approximated unity throughout the period of the review.

# TABLE 15:

## Mathematics Statistics for Males and Females relative to Base Year with respect to Peer Year 12 population.*

| Year | Queensland Type 1 Social M | F | Type 2 I M | F | Type 3 II M | F | New South Wales Type 1 2UA M | F | Type 2 2U M | F | Type 3 3U M | F | 4U M | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1970 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1972 | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 1973 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | — | — | — | — | — | — | — | — |
| 1974 | 1.05 | 0.98 | 0.97 | 0.99 | 0.97 | 0.88 | — | — | — | — | — | — | — | — |
| 1975 | 1.29 | 1.28 | 0.91 | 0.98 | 0.73 | 0.69 | — | — | — | — | — | — | — | — |
| 1976 | 2.77 | 2.29 | 0.91 | 0.94 | 0.62 | 0.68 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 1977 | 6.02 | 7.45 | 0.83 | 0.78 | 0.76 | 0.70 | 0.99 | 1.05 | 1.03 | 0.98 | 0.84 | 0.80 | 0.55 | 0.44 |
| 1978 | 6.93 | 9.37 | 0.79 | 0.81 | 0.75 | 0.72 | 0.90 | 1.05 | 1.03 | 1.00 | 0.90 | 0.81 | 0.56 | 0.44 |
| 1979 | 7.94 | 12.24 | 0.76 | 0.82 | 0.73 | 0.77 | 0.89 | 1.04 | 1.04 | 1.03 | 0.91 | 0.84 | 0.67 | 0.42 |
| 1980 | 7.93 | 15.98 | 0.74 | 0.94 | 0.66 | 0.92 | 0.76 | 1.04 | 0.93 | 1.15 | 0.89 | 1.00 | 0.75 | 0.72 |
| 1981 | 8.57 | 18.31 | 0.71 | 0.94 | 0.65 | 0.93 | 0.77 | 1.00 | 0.91 | 1.15 | 0.86 | 1.00 | 0.86 | 0.90 |
| 1982 | 8.77 | 20.00 | 0.70 | 0.96 | 0.64 | 0.94 | 0.72 | 1.03 | 0.92 | 1.21 | 0.81 | 0.98 | 1.00 | 0.91 |
| 1983 | 8.63 | 18.98 | 0.68 | 0.93 | 0.63 | 0.93 | 0.81 | 1.07 | 0.91 | 1.15 | 0.83 | 1.01 | 1.10 | 1.23 |
| 1984 | 5.57 | 12.43 | 0.66 | 0.89 | 0.57 | 0.85 | 0.93 | 1.13 | 0.86 | 1.06 | 0.83 | 1.05 | 1.03 | 1.39 |
| 1985 | 5.82 | 12.96 | 0.65 | 0.87 | 0.57 | 0.83 | 0.95 | 1.21 | 0.82 | 1.01 | 0.82 | 1.13 | 1.20 | 1.76 |
| Base Year | 1973 | | | | | | 1976 | | | | | | | |

| A C T Type 1 Maths 3 M | F | Type 2 Maths 2 M | F | Type 3 Maths 1 M | F | Victoria Type 1/2 General M | F | Type 3 Pure M | F | Applied M | F | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| — | | — | | — | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1970 |
| — | — | | | — | — | 1.05 | 1.15 | 0.85 | 1.01 | 0.84 | 0.96 | 1972 |
| — | — | — | | — | — | 1.15 | 1.31 | 0.77 | 0.90 | 0.76 | 0.88 | 1973 |
| — | — | — | — | — | | 1.20 | 1.46 | 0.77 | 0.88 | 0.71 | 0.84 | 1974 |
| — | — | — | — | — | — | 1.19 | 1.59 | 0.65 | 0.83 | 0.63 | 0.81 | 1975 |
| — | — | — | — | — | | 1.14 | 1.63 | [illegible] | 0.79 | 0.59 | 0.75 | 1976 |
| — | — | — | — | — | — | 1.15 | 1.71 | [illegible] | 0.82 | 0.60 | 0.79 | 1977 |
| — | — | — | — | — | — | 1.21 | 1.92 | 0.60 | 0.79 | 0.59 | 0.75 | 1978 |
| — | — | — | — | — | — | 1.20 | 2.03 | 0.60 | 0.81 | 0.59 | 0.77 | 1979 |
| — | — | — | — | — | — | 1.17 | 2.13 | 0.60 | 0.81 | 0.59 | 0.77 | 1980 |
| — | — | — | — | — | — | 1.25 | 2.22 | 0.63 | 0.85 | 0.61 | 0.79 | 1981 |
| 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.15 | 2.08 | 0.64 | 1.04 | 0.61 | 0.91 | 1982 |
| 0.98 | 1.05 | 1.06 | 1.87 | 1.02 | 1.09 | 1.05 | 1.99 | 0.62 | 1.00 | 0.59 | 0.88 | 1983 |
| 0.99 | 1.09 | 1.09 | 1.69 | 1.08 | 1.09 | 1.01 | 1.98 | 0.57 | 0.90 | 0.54 | 0.78 | 1984 |
| 0.94 | 1.12 | 1.17 | 1.76 | 1.03 | 1.15 | 1.07 | 1.95 | 0.51 | 0.79 | 0.49 | 0.69 | 1985 |
| 1982 | | | | | | 1970 | | | | | | Base Year |

| Year | Tasmania Type 1 Maths M | F | Type 2 Alg+Ge M | F | Type 3 An+St M | F | South Australia Type 1/2 IS M | F | Type 3 1 M | F | 2 M | F | Western Australia Type 1 IV M | F | Type 2 I M | F | Type 3 II M | F | III M | F | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1970 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1970 |
| 1972 | — | — | — | — | — | — | — | — | — | — | — | — | — | — | 1.22 | [illegible] | 0.81 | 0.82 | 0.85 | 0.90 | 1972 |
| 1973 | — | | — | — | — | — | — | — | — | — | — | — | — | — | 1.20 | 1.11 | 0.70 | 0.75 | 0.74 | 0.81 | 1973 |
| 1974 | 1.00 | 1.00 | — | | — | — | — | — | — | — | — | — | 1.00 | 1.00 | 1.12 | 1.01 | 0.65 | 0.69 | 0.70 | 0.76 | 1974 |
| 1975 | 2.70 | 2.22 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.67 | 2.51 | 1.00 | 1.12 | 0.49 | 0.67 | 0.53 | 0.74 | 1975 |
| 1976 | 3.39 | 2.08 | 1.42 | 1.69 | 1.24 | 1.40 | 1.00 | 1.00 | 0.94 | 0.91 | 0.94 | 0.91 | 1.91 | 3.02 | 0.98 | 1.06 | 0.45 | 0.61 | 0.48 | 0.68 | 1976 |
| 1977 | 2.73 | 1.93 | 0.78 | 0.96 | 0.81 | 0.69 | 0.97 | 1.00 | 0.98 | 0.93 | 0.98 | 0.92 | 1.76 | 3.49 | 0.89 | 1.10 | 0.45 | 0.63 | 0.49 | 0.70 | 1977 |
| 1978 | 3.96 | 3.43 | 0.95 | 1.05 | 1.24 | 1.70 | 0.86 | 0.95 | 1.04 | 1.04 | 0.92 | 1.04 | 1.57 | 2.98 | 0.90 | 1.18 | 0.40 | 0.66 | 0.43 | 0.74 | 1978 |
| 1979 | 3.85 | 3.72 | 0.79 | 0.53 | 0.94 | 1.08 | 0.84 | 0.93 | 1.04 | 1.11 | 0.93 | 1.12 | 1.55 | 3.21 | 0.93 | 1.15 | 0.40 | 0.66 | 0.44 | 0.74 | 1979 |
| 1980 | 3.54 | 3.79 | 0.80 | 0.58 | 1.09 | 1.27 | 0.75 | 1.03 | 0.94 | 1.27 | 0.94 | 1.27 | 1.76 | 3.34 | 0.96 | 1.20 | 0.38 | 0.68 | 0.41 | 0.76 | 1980 |
| 1981 | 3.94 | 3.94 | 1.34 | 0.77 | 1.10 | 1.25 | 0.66 | 0.96 | 0.96 | 1.49 | 0.96 | 1.49 | 1.78 | 3.58 | 0.92 | 1.22 | 0.38 | 0.61 | 0.41 | 0.68 | 1981 |
| 1982 | 4.79 | 5.24 | 1.31 | 1.52 | 1.51 | 1.65 | 0.65 | 1.06 | 0.98 | 1.59 | 0.98 | 1.59 | 1.73 | 3.45 | 0.86 | 1.09 | 0.37 | 0.67 | 0.40 | 0.75 | 1982 |
| 1983 | 4.99 | 4.97 | 1.00 | 0.92 | 2.03 | 1.66 | 0.70 | 1.05 | 0.89 | 1.47 | 0.90 | 1.47 | 1.95 | 3.61 | 0.89 | 1.12 | 0.37 | 0.66 | 0.40 | 0.73 | 1983 |
| 1984 | 4.53 | 4.69 | 1.06 | 0.83 | 1.56 | 1.47 | 0.66 | 1.04 | 0.83 | 1.31 | 0.84 | 1.31 | 2.19 | 3.65 | 0.87 | 1.07 | 0.34 | 0.63 | 0.37 | 0.70 | 1984 |
| 1985 | 4.31 | 4.64 | 1.26 | 1.19 | [illegible] | 1.30 | 0.64 | 1.00 | 0.76 | 1.20 | 0.76 | 1.20 | 2.14 | 3.61 | 0.92 | 1.07 | 0.32 | 0.55 | 0.34 | 0.65 | 1985 |
| Base Year | 1974 | | 1975 | | | | 1975 | | | | | | 1974 | | 1970 | | | | | | Base Year |

*Enrolment relative to base year with respect to Peer Year 12 population in 198X

$$= \frac{\text{Enrolment in course in 198X}}{\text{Enrolment in course in base year}} \times \frac{\text{Peer Year 12 population in base year}}{\text{Peer Year population in 198X}}$$



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## TABLE 16:

### Female Enrolment Ratios for Mathematics Subjects*

| Year | Queensland Type 1 Social | Queensland Type 2 I | Queensland Type 3 II | New South Wales Type 1 2UA | New South Wales Type 2 2U | New South Wales Type 3 3U | New South Wales Type 3 4U | A.C.T.** Type 1 Ma 3 | A.C.T.** Type 2 Ma 2 | A.C.T.** Type 3 Ma 1 | Victoria Type 1/2 General* | Victoria Type 3 Pure | Victoria Type 3 Applied | Tasmania Type 1 Maths | Tasmania Type 2 Alg +Ge | Tasmania Type 3 An +St | South Australia Type 1/2 IS | South Australia Type 3 1 | South Australia Type 3 2 | Western Australia Type 1 IV | Western Australia Type 2 I | Western Australia Type 3 II | Western Australia Type 3 III | Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1970 | — | — | — | — | — | — | — | — | — | — | 1.61 | 3.10 | 3.56 | — | — | — | — | — | — | — | 1.14 | 4.22 | 4.31 | 1970 |
| 1972 | — | — | — | — | — | — | — | — | — | — | 1.43 | 2.64 | 3.02 | — | — | | — | — | | — | 1.17 | 4.08 | 3.96 | 1972 |
| 1974 | 1.43 | 0.99 | 4.00 | — | — | — | — | — | — | — | 1.33 | 2.56 | 2.99 | 1.64 | — | — | | — | — | 1.19 | 1.10 | 3.47 | 3.46 | 1974 |
| 1976 | 1.58 | 1.15 | 4.11 | 0.95 | 1.08 | 2.10 | 3.62 | — | — | — | 1.14 | 2.39 | 2.80 | 2.68 | 3.26 | .46 | 1.28 | 3.06 | 3.06 | 0.75 | 1.06 | 3.11 | 3.09 | 1976 |
| 1977 | 1.00 | 1.19 | 3.61 | 0.83 | 1.05 | 2.06 | 4.24 | — | — | — | 1.12 | 2.35 | 2.73 | 2.32 | 3.13 | 4.55 | 1.14 | 2.82 | 2.83 | 0.60 | 0.91 | 3.01 | 3.02 | 1977 |
| 1978 | 0.90 | 1.05 | 3.41 | 0.72 | 0.89 | 2.07 | 4.56 | — | — | — | 1.04 | 2.39 | 2.80 | 1.90 | 3.47 | 2.83 | 1.00 | 2.53 | 2.55 | 0.62 | 0.86 | 2.57 | 2.57 | 1978 |
| 1979 | 0[illegible] | [illegible] | [illegible].00 | 0.69 | 0.93 | 1.96 | 5.27 | — | — | — | 1.00 | 2.33 | 2.73 | 1.70 | 5.78 | 3.40 | 1.02 | 2.40 | 2.40 | 0.57 | 0.92 | 2.58 | 2.59 | 1979 |
| 1980 | 0.72 | 1.41 | 2.86 | 0.69 | 0.87 | 1.88 | 3.83 | — | — | — | 0.88 | 2.31 | 2.72 | 1.54 | 5.30 | 3.67 | 1.03 | 2.39 | 2.39 | 0.62 | 0.91 | 2.35 | 2.32 | 1980 |
| 1981 | 0.69 | 1.35 | 2.78 | 0.73 | 0.85 | 1.80 | 3.43 | — | — | — | 0.91 | 2.30 | 2.73 | 1.64 | 6.77 | 3.43 | 0.97 | 2.09 | 2.10 | 0.59 | 0.85 | 2.64 | 2.63 | 1981 |
| 1982 | 0.64 | 1.31 | 2.68 | 0.66 | 0.82 | 1.74 | 4.00 | 0.99 | 1.24 | 1.27 | 0.89 | 1.93 | 2.39 | 1.50 | 3.35 | 3.55 | 0.87 | 1.99 | 1.98 | 0.60 | 0.90 | 2.31 | 2.32 | 1982 |
| 1983 | 0.67 | 1.32 | 2.65 | 0.72 | 0.85 | 1.72 | 3.16 | 0.99 | 0.70 | 1.19 | 0.85 | 1.93 | 2.40 | 1.65 | 4.23 | 4.78 | 0.94 | 1.98 | 1.97 | 0.64 | 0.90 | 2.39 | 2.39 | 1983 |
| 1984 | 0.66 | 1.31 | 2.66 | 0.78 | 0.87 | 1.66 | 2.70 | 0.90 | 0.80 | 1.27 | 0.82 | 1.99 | 2.47 | 1.59 | 4.92 | 4.15 | 0.90 | 2.06 | 2.06 | 0.71 | 0.93 | 2.24 | 2.25 | 1984 |
| 1985 | 0.66 | 1.33 | 2.70 | 0.74 | 0.87 | 1.52 | 2.47 | 0.83 | 0.82 | 1.14 | 0.89 | 2.02 | 2.51 | 1.53 | 4.44 | 3.49 | 0.91 | 2.04 | 2.03 | 0.71 | 0.97 | 2.27 | 2.27 | 1985 |

$$\text{*Ratio} = \frac{\text{Total Male Year 12 enrolment in course in given year}}{\text{Total Female Year 12 enrolment in course in same year}}$$

**No male/female breakdown by course type available prior to 1982

Enrolment statistics in New South Wales were only available for the period 1976-1985. Table 14 demonstrates the absolute increase in numbers studying the *Type 1* and *Type 2* courses and the fluctuations in those for the *Type 3* course. Both male and female enrolments relative to the Peer-Year-12 population show small increases in the two-unit *Type 2* course (Table 15) until 1980 when the male enrolment fell below unity. Marginally smaller decreases in male enrolments existed for the *Type 3* courses than in the corresponding female enrolments, but the situation has changed considerably since 1980. This information must be considered in the context of a disparity in the retentivity rate for males and females demonstrated during the period from 1976 to 1985. Thus when the enrolment trends are considered in terms of changes in the Parent-Year-8 population, female enrolments have increased in the *Type 1* and *Type 2* courses while the male enrolment decreased. The decrease in enrolments in the three unit *Type 3* course is less marked for females, while the female enrolment in the four unit *Type 3* course has recovered dramatically since the post-1977 slump. Perhaps the most significant detail to be noted *(Table 16)* is the ratio of male to female students over the various courses. In the most academically-oriented Mathematics 4U *Type 3* course, there were over five times as many males enrolled as females in 1979. The ratio has now settled to around 3:1. In the *Type 1* and *Type 2* courses, females outnumber males five to four.

For the ACT, no data concerning the breakdown of enrolments by course type were available until 1982. Table 14 depicts the steady increase in absolute enrolments in each course since the data have become available. Relative to the Peer-Year-12 population, increases in the three types of course are evident for both males and females with the exception of males in the *Type 1* course. The most pronounced increases parallel each other in the *Type 2* and *Type 3* courses *(Table 15)*. Females exceed males in number in both *Type 1* and *2* courses *(Table 16)*.

Enrolments in Victoria for the *Type 1/2* General Mathematics course have more than doubled since 1970, with at least part of the increase since 1976 resulting from the introduction of the computing option *(Table 14)*. Parallel decreases in the two co-requisite *Type 3* courses were evident until 1981. The male/female ratio in the dual purpose General Mathematics course *(Type 1/2)* has dropped below unity, indicating females exceed males. While this ratio is decreasing in all three types of courses, male enrolments outnumber females by over two to one in the *Type 3* courses. Table 15 indicates steady decreases in both male and female enrolments relative to Year 12 for the *Type 3* courses, the most specialised of the courses available.

Tasmanian enrolments in the *Type 1* course have increased 5-fold since 1974 whilst little change has occurred in the relatively small enrolments in both *Type 2* and *3* courses since 1974/75 *(Table 14)*. Relative to the Peer-Year-12 population, the significant increase in male and female enrolments in the *Type 1* course have paralleled each other, while a slight improvement is shown for the male but not the female enrolment in the *Type 2* course

(*Table 15*). The data in Table 16 are interesting in that they reveal that males predominate in numbers in each type of course available, with around four times as many in both *Type 2* and *Type 3* courses.

The *Type 1/2* courses in South Australia show a decrease in male enrolments relative to Year 12, while female numbers increase slightly (*Table 15*). The *Type 3* courses Mathematics 1 and Mathematics 2 are usually studied as a double course, so trends in one directly parallel those in the other (*Table 14*). For these courses, the male/female rati  has decreased steadily but remains slightly greater than two to one (*Table 16*). This ratio has decreased for the dual purpose *Type 1/2* Mathematics IS course since 1980, indicating that females exceed males in this course. Both Type 3 courses dem  nstrate increases in female enrolments since 1975 when examined relative to the Year 12 population (*Table 15*). Male enrolments have decreased since 1982.

Western Australian statistics in Table 14 reveal the increase in absolute enrolments in the *Type 1*, Mathematics IV course since 1974. Numbers doubled in this course within two years of its introduction and have continued to rise. This trend is apparent not only in the actual enrolments of Table 14, but also relative to the Year 12 peer group (*Table 15*). The *Type 2* course, Mathematics I, also shows an increase since 1970 both in absolute numbers and relative to the Year 12 peer group for females only (*Table 15*). For the *Type 1* course also, the most significant feature lies in the increase in the female enrolment (*Table 15*). The ratio of male to female enrolments in all three course types has fluctuated over the period 1970-85, but nevertheless reveals that more than twice as many males as females are studying the *Type 3* courses. Both male and female enrolments have remained fairly constant over the period of review (*Table 16*).

Concerning the *Type 2* course, there has been a small but steady predominance of females opting for these studies, with a corresponding though more pronounced swing in the *Type 1* offering. The two *Type 3* courses in Western Australia are usually studied concurrently, so that trends in each run parallel. Both demonstrate a decline in male and female enrolments relative to the Year 12 parent group, with this decrease most marked among male students (*Table 15*).

## 2.5 COMPUTING STUDIES

Whilst the main thrust of this monograph has addressed science and mathematics enrolments and trends, it would be an oversight to ignore the related and fast-growing area of computing studies. Since the late 1970's studies in this area have becoming increasingly available at the Year 11 and 12 level in each State.

The lifestyle and employment patterns of Australians have altered significantly in recent years, due in no small part to technological changes that have occurred over that time period. A need for a greater proportion of the student population to understand and apply information technologies has resulted in the appearance of these computing studies subjects. Study in this area is acclaimed by educators and employers as highly relevant to our society because of the growing number of aspects of our lives which are dependent upon computer technology.

Several of these courses are in the pilot stage in a number of States at the time of publication of this monograph. Because of this and because computing options which formerly existed within certain subjects have recently been elevated in status to subjects in their own right, the data available are, in several cases, incomplete or not as detailed as would be preferred.

### Computing/Computer Science Enrolment Statistics

As this monograph goes to press, a new syllabus on *Information Processing and Technology* is being trialled in Queensland with approximately 275 students in seven schools. Hitherto, units in computer studies of one semester's duration have been available as options/streams within several other courses - for example, *Computer Mathematics* within the senior Mathematics syllabus, *Computers* within the senior Mathematics in Society syllabus, and as subunits within the Accounting syllabus. However, enrolment data on such units are not presented here. Some individual schools also offer courses in computer studies. These courses are prepared by the schools and are recorded on Board Certificates in the category of Board-Registered School Subjects

In New South Wales there are no externally examined computer studies courses existing in their own right at the time of publication of this monograph, although a computer studies syllabus committee has been convened to develop a syllabus for Year 11 and 12 students. The two-unit Mathematics in Society subject does contain an optional computing element which is studied by a majority of the students taking this subject. Individual schools are at liberty to offer computing courses which fall into the "Other Approved Studies" (OAS) category and, as such, are assessed by the schools themselves. Approximately half of the schools in the State have developed OAS courses in computer studies. No data on these courses are presented here.

In the Australian Capital Territory, Year 12 enrolment information is obtained on a school/college basis by the Accrediting Agency of the ACT School's Authority. Enrolment data date back to 1977 for the unit *Computing* and appear in Table 17. This unit attracted few females until 1982 when enrolments doubled to just over 100. Male enrolments have increased steadily over the nine-year period and represent 77% of the total enrolments in the last two years.

## TABLE 17:

**Computing studies enrolment statistics in ACT, Victoria, Tasmania and Western Australia**

| Unit | Year | Enrolments Male | Female | Total |
|---|---|---|---|---|
| AUSTRALIAN CAPTITAL TERRITORY | | | | |
| | 1977 | 62 | 25 | 87 |
| Computing | 1978 | 99 | 16 | 115 |
| | 1979 | 149 | 29 | 178 |
| | 1980 | 217 | 60 | 277 |
| | 1981 | 217 | 44 | 261 |
| | 1982 | 272 | 113 | 385 |
| | 1983 | 323 | 101 | 424 |
| | 1984 | 419 | 139 | 558 |
| | 1985 | 398 | 111 | 509 |
| VICTORIA | | | | |
| | 1976 | — | — | 163 |
| General Mathematics | 1977 | — | — | 306 |
| (Computing Option) | 197'' | — | — | 319 |
| | 1979 | 318 | 139 | 457 |
| | 1980 | 285 | 99 | 384 |
| | 1981 | — | — | 520 |
| | 1982 | — | — | 644 |
| | 1983 | 312 | 309 | 621 |
| | 1984 | 387 | 469 | 856 |
| | 1985 | — | — | 706 |
| Computer Science | 1981 | 77 | 64 | 141 |
| | 1982 | 107 | 79 | 186 |
| | 1983 | 175 | 73 | 248 |
| | 1984 | 413 | 135 | 548 |
| | 1985 | 565 | 223 | 788 |
| TASMANIA | | | | |
| | 1980 | — | — | 427 |
| Computer Studies | 1981 | — | — | 447 |
| (Level III) | 1982 | — | — | 536 |
| | 1983 | 448 | 220 | 668 |
| | 1984 | 502 | 200 | 702 |
| | 1985 | 512 | 209 | 721 |
| WESTERN AUSTRALIA | | | | |
| | 1982 | 36 | 18 | 54 |
| General Computing | 1983 | 63 | 38 | 101 |
| | 1984 | 90 | 55 | 145 |
| | 1985 | 136 | 75 | 211 |

Victoria provided a computing option within the unit General Mathematics for the first time in 1976. Global statistics only for this option were retained between 1976 and 1982, with details of the male/female breakdown included for 1979/80 and 1983/84. Full statistics for a new unit *Computer Science*, introduced in 1981, have been published since that year. The available statistics for both these computer-oriented subjects appear in Table 17. While the total numbers represent small percentages compared with the age cohort, the sharp increase in enrolments over 1983/85 in *Computer Science* is worth noting. It will be interesting to see if the attractiveness of this unit is maintained.

Tasmania has offered *Computer Studies* as a full Level III subject of one year's duration since 1980. This subject has also been available as a one-yea Level II subject. A Higher School Certificate subject *Information Technology*, which is made up of three approved units each of one-term's duration, has been available since 1984, and a range of 21 units i available for this Level II subject. . new one-year Level III subject, *Information Systems*, was introduced in 1986. The Level III Computer Studies enrolments appear in Table 17. Male and female enrolments are only available from 1983 to 1985, consequently, it is not appropriate to draw conclusions from this data.

Whilst there are no computing units offered as public examination subjects in South Australia, at the time of publication of this monograph, a *Computing Studies* syllabus is being evolved from a school-assessed subject which was first taught in schools in 1982. The new syllabus has been designed to cater for the greatest possible range of students, and is offered as a set of ten distinct modules which may be organised in a variety of different combinations depending on the particular objectives sought by schools or by students. *"Computer Implications"*, *"Introduction to Programming"* and *"Computer Applications"*, are three titles from amongst the modules which were to be taught in some sixty schools throughout the State at Year 12 level for the first time in 1986.

The first computing/programming unit at public examination level in Australia was the module *Computing* (MINIWAFT), a programming unit based on the FORTRAN language, which appeared as one of ten modules within the new unit Mathematics IV introduced into Western Australia in 1974. It was followed shortly after by a further module, *Computing* (BASIC), but both were dropped from the Mathematics IV syllabus around 1982 to make way for a new unit, *General Computing*, introduced in that year. Statistics on the numbers choosing those early programming modules have been difficult to ascertain and are not presented here. Enrolment data representing the four years of *General Computing* appears in Table 17. A syllabus committee is currently working on a second computing unit proposed for introduction in 1987.

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# ENROLMENT TRENDS

## 3.1 NATIONAL OVERVIEW

The data presented in Chapter 2 demonstrated that the enrolment pattern for all Year 12 students for the period 1970 to 1985 *(Table 1)* has been one of gradual increase in the total population during the 1970's followed by rapid yearly increases commencing in 1981. Two quite distinct enrolment patterns emerge for the female and male population data. For females, a steady yearly increase in enrolments was evident from 1970 to 1978, followed by a significant yearly increase from 1981 to 1985. The overall effect of all these increases has been that the female Year 12 population has more than doubled over the sixteen-year period. In contrast, male enrolments increased between 1970 and 1977, then a yearly enrolment decline from 1978 to 1982 was evident, followed by significant yearly enrolment increases from 1983 to 1985. The overall effect has been a 46% increase in enrolments since 1970.

A variety of reasons have been put forward to explain the above phenomena (Merrilees, 1981; Commonwealth Tertiary Education Commission, 1982; Commonwealth Schools Commission, 1983). The increased propensity for females to complete Year-12 school studies in both the public, independent and catholic school systems (Australian Bureau of Statistics, 1985) may be due to the following factors:—

- the increased level of youth unemployment, causing females to remain at school and encouraging others to go on to tertiary studies·
- the increasing realisation by society that females have the capacity to succeed in many previously male-dominated professions.
- expanding opportunities for females in jobs previously the domain of males e.g. secondary school teaching, science, engineering and the information-based professions, data processing, the media, law and administration. For most of these jobs a tertiary education is a prerequisite.

Aberrations in the enrolment patterns between 1976 and 1981 are complex and difficult to explain. There is some evidence to suggest that many students who dropped out of school early in the late 1970's and early 1980's were among the most able students. For example, Williams (1982) found that approximately 30% of high school "drop-outs" were male high school students from the upper quartile in terms of achievement and ability. The claim was made that these young men sought and obtained employment in the apprenticeship field (Williams, 1982; Merrilees, 1981), rather than register for "the dole" as had been popularly believed.

There is also evidence that unemployment trends in this period had the effect of encouraging school-age males to obtain any job which was available, even if at a lower career level than planned (Hayden, 1982). This picture has changed during the 1980's because of a sharp decline in apprenticeships. Thus many more able male youths are once again remaining at school to complete secondary education.

## 3.2 SCIENCE

### Biology

The statistics presented in Table 2 and Figure 3 indicate that the actual number of students studying biology as a Public Examinations subject has shown a slow increase in the 1970's followed by a decline in the early 1980's. However, enrolments have increased in 1983 to 1985, reflecting in part the rapid growth in the Year 12 population in these two years. A decline in student enrolments has occurred in NSW and South Australia, whereas significant increases have occurred in Queensland and Western Australia.

The increasing population at Year 8 level in Australian secondary schools, coupled with an increased retentivity to Year 12, has produced a dramatic increase in student numbers in Year 12 over the past few years. This has been accompanied by a decreasing proportion of the Year 12 cohort studying biology in all States except Victoria, Queensland and Western Australia, although with respect to the Parent-Year-8 population the proportion is now larger than in the early 1970's in almost every State.

The dramatic increase in female retentivity which has occurred throughout Australia over the past ten years has been reflected in an increase in female enrolments in biology. However, in some States this trend has been accompanied by a decline in male enrolments in the subject. For example, female enrolments have increased by approximately 10% in the 1977 to 1985 period whereas the male enrolments declined by approximately 5% over the same interval.

The significant increases in biology enrolments in the 1960's as reported by Dow (1971) continued in the early 1970's. A contributing factor in this rapid increase can be attributed to the introduction of the Australian Academy of Science **Web of Life** course. However, in the late 1970's and early 1980's the enrolments stabilised but have increased again in the last three years. In the light of the increasing retentivity to Year 12, particularly amongst females, and the larger age cohort entering Year 12, one would predict that the number of students studying biology will continue to increase in the immediate future.

## Chemistry

The statistics presented in this monograph indicate that the actual number of students studying chemistry as a Public Examinations subject has shown a slow but steady increase from 1976 to 1985. In addition, a small but nevertheless important group of students are now studying physical science, and this has had the effect of increasing the number of students in some States studying units with a significant chemistry content. The increasing population at Year 8 level in Australian secondary schools, coupled with an increased retentivity to Year 12, has produced a dramatic increase in student numbers at the Year 12 level in the last few years. This has been accompanied by a decreasing proportion of the Year 12 cohort studying chemistry in the mid-1980's than has been the case in the past. Whilst an ever-decreasing proportion of Year 12 students are opting for chemistry, a slightly greater proportion of the age cohort are studying chemistry, particularly if physical science enrolments are included.

Thus, the situation of chemistry as an important component of secondary school education in the 1980's is better than may have been expected by the 1960 trends examined by Dow (1971), where enrolments in chemistry were predicted to decrease. The dramatic increase in female retentivity which has occurred throughout Australia over the past ten years has been reflected in an increase in chemistry enrolments. In 1985 approximately 40% of the students enrolled in Year 12 chemistry were females compared to 31% in 1977. The changing attitude of females to chemistry has presumably been assisted by efforts to encourage females to widen their occupational horizons and to realise that many careers which require a physical science background are available to them (D'Alpuget, 1979). Certainly it is essential, at a time when there is a growing realisation that our traditional agriculture and mining-oriented base must be broadened to encompass technological developments, that we must not neglect the talent of the female population.

Science educators also need to be aware of the fact that the future of Australia in an increasingly technological world depends on our ability to improve the scientific literary of our burgeoning secondary school population. This implies the need to cater, in a more appropriate manner, for the wider range of abilities which now exist in the senior level of our secondary schools. A physical science unit seems to have been successful in Western Australia in appealing to a different group of students who opt for chemistry. Perhaps this or other similar units, embracing aspects of chemistry, should be developed within each State.

## Geology

One of the factors affecting the number of students opting to study a science subject at Years 11 and 12 in secondary school is the quality and appeal of the science courses offered. Sleet and Stern (1980) have identified student interest as a major factor influencing subject selection in science, which in turn is a major factor in the choice of a career. The Australian Academy of Science has played a very important role in science education in Australia by developing a number of courses appropriate for the senior levels of secondary education. Courses in biology (Morgan, 1978), chemistry (Watts, 1983) and geology (Clark, 1983) have been developed which include a full complement of teaching materials, text books and audiovisual materials.

The Australian Academy of Science School Geology project is of importance to the future of geology education in this country. Geology has for far too long been a "poor relation" when compared to the major science subjects of biology, chemistry and physics; it is to be hoped that in the next decade the number of students studying geology at the secondary level will increase significantly, as it is a subject which could appeal to students with a wide range of abilities. The proportion of females completing secondary education has increased dramatically over the past decade and it is likely that a proportion of these students could be encouraged to study geology. It is also important for the community to be aware of the changes occurring within the geological profession as a result of societal pressures. A better-informed society would be able to make intelligent comment on matters relating to the development and use of mineral, energy and water resources; issues which will affect all Australian citizens in the immediate future.

It is of course true that chemistry and physics form a good science base on which to build a professional course in geology, but many students who do not wish to undertake a tertiary course requiring these subjects as a basis, could benefit from a secondary level course in geology. Geology needs to enhance its public image and one way of achieving this is to increase the role of geology as a secondary school subject. The geoscience industry in particular will need to take a more responsible attitude about maintaining staff levels in future periods of down-turn, since in the past the petroleum and mineral industries have been subject to peaks and valleys in the demand for geoscientists.

The statistics presented in this monograph indicate that the actual number of students studying geology in Australian secondary schools has steadily declined over the past decade from 4,124 in 1976 to 3,128 in 1985. The introduction of the Australian Academy of Science Geology programme to date has had no significant impact on student enrolments, although the enrolment trends in South Australia were undoubtedly affected by the fact that much of the development of the geology programme was carried out in that State. The decline in student numbers has taken place against a scenario of increasing student numbers in Year 12 due to a combination of increased retentivity and larger age cohort. One may have expected that the wider range in student ability now present in the senior level of secondary education may have led to an increase in geology enrolments rather than the decrease which has occurred. The rapid increase in Peer-Year-12 population in 1983 to 1985 depicted in Figure 2 is not reflected in the geology Year 12 enrolment.

The dramatic increase in female retentivity which has occurred over the past ten years, coupled with efforts which have been made to encourage females to widen their occupational horizons, would have been expected to produce more interest in geology amongst females than seems to have been the case. In fact, the number of females studying geology declined by approximately 25% from 1977 to 1985, whilst over the same period the male enrolment declined by a somewhat lesser amount.

## Physics

When Dow (1971) surveyed Australian secondary science enrolment patterns in the period 1960 to 1969, he concluded that the proportion of students taking physics with respect to the total pool of available students in that age group was decreasing in all States. The statistics presented in this study indicate that the actual number of students studying physics as a Public Examinations subject has been steady at approximately 25,000 over the period 1976-1982, but this has gradually risen to over 29,000 in 1985. In addition a small but nevertheless important group of students are now studying physical science and this would increase the numbers of students studying units with a significant physics content in some States.

The increasing population at Year 8 level in Australian secondary schools, coupled with the retentivity trends to Year 12, indicate that the dramatic increase in student numbers, which has occurred at the Year 12 level in the last few years, implies that a decreasing proportion of the Year 12 cohort will be studying physics in the late-1980's than has been the case in the past. Apart from NSW and ACT, the proportion of Year 12 physics enrolments to the Year-12 cohort in 1985 is approximately 60% of the value in the 1970 base year. On the other hand, the proportion of physics students in Year 12 in 1985, with respect to the Parent-Year-8 cohort 4 years earlier, is greater than the corresponding enrolment in the appropriate base year for all States except Victoria.

Whilst an ever-decreasing proportion of Year 12 students are opting for physics, a slightly greater proportion of the age cohort are studying physics, particularly if physical science numbers are included. Thus, the situation of physics as an important component of secondary school education in the 1980's is far better than may have been expected by the 1960 trends examined by Dow (1971). However, the dramatic increase in female retentivity, which has occurred throughout Australia over the past ten years, has not been reflected in comparable increases in physics enrolments.

In 1984 approximately 26% of the students enrolled in Year 12 physics were females and the proportion has increased slowly over the past decade The changing attitude of females to physics has presumably been assisted by efforts to encourage females to widen their occupational horizons and realise that many careers which require a physical science background are available to them (D'Alpuget, 1979).

The subject Physical Science seems to have been successful in Western Australia in appealing to a different group of students than those who opt for physics and chemistry. Perhaps this or other similar units embracing aspects of physics should be developed within each State.

## Miscellaneous Science Subjects

Since 1980, an increasing number of new science-based subjects have become available as Public Examination subjects. General Science (Multistrand Science or Multidisciplinary Science), Physical Science, Environmental Science and Agriculture have been most prominent. In 1980, the total enrolments for these subjects was approximately 1,500 but they have increased to over 8,000 in 1985. General Science accounted for approximately 6,000 enrolments in 1985 and this was about t[illegible] the total Australian geology enrolment for that year Obviously the introduction of these new science subjects can be seen as a significant development in attracting students to study science. Since most of these subjects have only become available in the last few years, it is not possible to make definitive comments regarding trends. However, two patterns emerge from the Physical Science and General Science enrolment statistics presented in Tables 7 and 8. Firstly, in each State and the ACT where these subjects have been offered, significant increases in enrolments were experienced since their inception. Most prominent are the General Science enrolments which in both Queensland and NSW have approximately doubled in a 5-year period. Secondly, in contrast to the major science subjects, enrolments for both General Science and

Physical Science have male and female enrolment ratios that are approximately equal. In the ACT an increasing number of new science subjects continue to attract students. Educational authorities in other States have also realised that students are attracted to these subjects and new units are being developed to cater for this phenomenon.

## 3.3 MATHEMATICS

The statistics presented in Table 12 and Figure 13 indicate that the actual number of students studying mathematics as a Public Examinations subject has shown a steady increase from 1976 to 1985. The increasing population at Year 8 level in Australian secondary schools, coupled with an increased retentivity to Year 12, has produced a dramatic increase in student enrolment numbers at the Year 12 level in the last few years. This increase has been accompanied by an increasing proportion of the Year 12 cohort studying mathematics, which has no doubt been encouraged by the number and variety of subjects offered in each State at the upper secondary school level.

At a national level, *Type 1* courses demonstrate trends similar to overall course enrolments with the increases in female enrolments being of greater magnitude than those for males. The ratio of male to female enrolments are decreasing for these general courses in all States except Tasmania. Generally the trend is clear; more females are choosing *Type 1* courses than are males.

Concerning *Type 2* courses, trends in enrolments are as varied as the overall statistics. Overall trends vary in terms of the proportion of the age group enrolled, from small increases in the New South Wales 2 Unit course and the South Australian IS course, to significant increases in Western Australia and Queensland Mathematics I courses. It is difficult to generalise about the *Type 2* courses in terms of male-female ratios as no consistent pattern is apparent.

*Type 3* courses show similar trends for both males and females in terms of enrolment proportions and relative changes. Since the female retentivity rate in most States since 1970 has been greater than that for males, female enrolments are larger when proportions of the Parent-Year-12 population are considered. The most significant feature of the mathematically-specialised programmes in most States is that they are studied by at least twice as many males as females. With the exception of Tasmania, the male/female ratios show a consistent trend ranging from more than twice as many males in *Type 3* courses, through approximately equal numbers in *Type 2* courses, to a higher female enrolment than male in *Type 1* courses. The trend in all ratios indicates an increase in the number of females studying mathematics at all levels in the last two years of secondary schooling, thus reflecting the national tendency for females to remain in school longer.

It is apparent that the position of mathematics as an important component of secondary school education in the mid-1980's has been maintained when compared with the trends apparent over the period 1970-1979. The dramatic increase in female retentivity which has occurred throughout Australia over the past ten years has been reflected in an increase in mathematics enrolments. In 1985, approximately 46% of the students enrolled in Year 12 mathematics were females compared to 41% in 1977. The changing attitude of females to mathematics has presumably been assisted by efforts to encourage them to widen their occupational horizons and realise that many careers which require a mathematics background are available to them. (Fennema et al, 1981; Moss, 1982; Lingard, 1983).

As in the case of science education, we must not neglect the mathematical talent of the female population. Mathematics educators must also be aware of the fact that the future of Australia in an increasingly technological world depends on our ability to improve the mathematical literacy of our burgeoning secondary school population. This implies the need to cater, in a more appropriate manner, for the wider range of abilities which now exist in the senior level of our secondary schools. Business and Social Mathematics units introduced into several States seem to have been successful in appealing to a group of students apprehensive of the more rigorous forms of the subject; these groups of students are additional to the usual clientele of such units. Perhaps similar units should be developed within other States.

## 3.4 COMPUTING STUDIES

The foremost reason for the apparent late arrival of computing studies onto the secondary school scene in Australia was undoubtedly the lack of access to hardware. The MINIWAFT course introduced into Western Australia in 1974 relied on a main frame and required a student to punch his or her own specially-prepared card decks with the aid of a paper-clip. Turnaround time was lengthy and the ever-necessary "debugging" sessions added to the delay and heightened teacher and student frustration. Even when microcomputers became available in adequate numbers in the early 1980's, their cost was prohibitive and the appropriate software was relatively scarce. Consequently it has only been within the last few years, when hardware costs have been reduced, that the well-equipped computing laboratory has begun to appear in schools across the country.

The availability of publically-examined computer study courses at secondary level reflect these teething problems. No computing studies courses are generally available yet in Queensland, New South Wales and South Australia, although Queensland is presently trialling a course. A computing option is available within a regular mathematics course in New South Wales where many schools offer "Other Approved Studies" on computing, and a computing studies syllabus is being developed and taught in South Australia for the first time in 1986.

In the remaining three States and the ACT, the total enrolment in such courses has increased from approximately 1700 in 1982 to almost 3100 by 1985. Since these units have only become available in the last few years, it is not possible to make definitive comments regarding trends. Nevertheless, two patterns emerge from the Computing Studies enrolment statistics presented in Table 17. First, in each State and the ACT where these subjects have been offered, significant increases have characterised their availability. Though total numbers are still registered in the 100's, two to seven-fold increases are evident in each State. Second, as with the more rigorous mathematics subjects, male-female ratios are greater than one, indicating that more males than females are studying these units. The one exception to this scenario is in the computing option within the General Mathematics course offered in Victoria. There would seem to be little doubt that, as syllabi are developed and evaluated in these units, as teachers become familiar with them, and as essential hardware costs come within the means of schools, their attractiveness will increase. The demand of employers for students well-versed in computing skills will provide an added incentive for students to pursue this field of study.

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# IMPLICATIONS OF THE ENROLMENT TRENDS

## 4.1 INTRODUCTION

The foregoing chapters have highlighted the fact that in the past three decades a considerable number of significant changes have occurred in the number of secondary school science and mathematics subjects available to students, and the corresponding enrolment trends in these subjects. Any consideration of the implications of those trends needs to be considered in the context of preceding changes. That context is provided in the first part of this chapter and will be used as a basis for a discussion of the implications of the observed trends.

Up to the mid-1960's, secondary and tertiary education in Australia was modelled on the British education system. The genesis for change in the 1960's can be attributed to two interrelated factors. Firstly, increased public awareness and involvement in education was triggered by the launch of Sputnik in the USSR which jolted the Western world, and in particular the USA, into the realisation that their education system was not keeping up with that of the USSR, nor preparing its youth for an increasingly technological society. Secondly, there was a rapid expansion in the number of Universities and Colleges of Advanced Education in Australia ready to accept students for post-secondary studies.

Changes introduced at both the primary and lower secondary levels necessitated significant alterations to existing syllabi in upper school science and mathematics. In many instances this resulted in significant modifications to syllabi and the introduction of new subjects in order to better cater for those students studying mainly non-science subjects, and for the larger cohort of students remaining at school until Year 12. The growth in this Year 12 cohort, which first became prominent in the 1960's, has been identified as a major reason for the wider range and availability of school subjects. These phenomena also had an increasing impact on science enrolments, which had declined with respect to the Year 12 enrolments.

## 4.2 SUMMARY OF TRENDS

### Upper Secondary Science

Dow (1971), who surveyed science enrolment patterns at the upper secondary school level for the period 1960-69, concluded that the proportion of students taking chemistry and physics in all States was decreasing. However, the decline was more than outweighed by the increasing proportion of students studying biology.

The enrolment patterns in science that emerged in the late 1960's continued through to the 1970's and were as follows:—

- **Biology** - With the exception of New South Wales, there has been a two to three-fold increase in enrolments in each State. The number of females taking biology far outweighed male enrolments. A levelling off of enrolments occurred in each State towards the end of the decade.
- **Chemistry** - A decline in enrolments in South Australia has been evident while in every other State there has been an overall increase. In each State there has been significant increases in female enrolments.
- **Geology** - Enrolments have remained relatively stable and represent the smallest enrolment of the four major science subjects.
- **Physics** - The trends are similar to those for chemistry.

In the 1980's the trends of the late 1970's continued through to 1981/1982, but then began to change as follows.-

- **Biology** - With the exception of the ACT and Tasmania, significant increases in enrolments occurred. These were most rapid for females who now outnumber male enrolments in each State by approximately a factor of two.
- **Chemistry** - Except for Tasmania, South Australia and the ACT, enrolment increases occurred. Females now account for between 36-44% of chemistry enrolments in the different States.
- **Geology** - Enrolments have declined during the 1980's.
- **Physics** - Enrolments have paralleled chemistry trends. Females now account for approximately 25% of the enrolments in the different States.

### Upper Secondary Mathematics

The most outstanding feature of mathematics enrolments in Australia over the period 1970-1985 has been the number of Year 12 students electing to study *Type 1* or terminal courses. The male to female ratio in these courses has decreased, highlighting a second feature of mathematics enrolments - the dramatic increase in the number of females in all types of mathematics courses offered. The enrolment patterns in *Type 2* courses have varied from State to State over the period of review, however the total number of students enrolled has steadily increased, with approximately equal numbers of males and females being a feature of this development. *Type 3* courses have been characterised by small increases in the total number of students enrolled, with about twice as many males as females electing to study these, the most rigorous of all the mathematics units available. The statistics presented in Chapter 2 reflect the nationwide trend for females to remain at school longer, and their heightened interest in the large number of available mathematics units. Consequently, as Figure 12 illustrates, most students at Year 12 level in Australia study at least one mathematics subject.

### Computing Studies

Few specific conclusions can be drawn from the limited data available, however a number of general comments can be made. Whilst computer-based studies are firmly entrenched as syllabi in many Australian States, they have been slow to become established in others. The cost of hardware together with the lack of software, skilled teachers and resources. have undoubtedly been the main causes of this situation. These factors have taken time and money to overcome and will continue to limit the development of these studies. In those States which lead in this field, the trend in the immediate past has been to increase the number of computer-based subjects available - an inclination which has been particularly noticeable in New South Wales, Victoria and Western Australia. The rapid growth in computer studies enrolments in these States suggests that many students are gaining strong upper secondary school preparation in computing. The situation parallels that which has occurred with mathematical studies in the various States - the wider the menu of units to choose from, the greater has been the response from the student body. Consequently dramatic increases in the number of males and females enrolling in computer studies are evident, and this phenomenon is likely to continue in the years to come.

## 4.3 REASONS FOR THE TRENDS

### Science

Based on the education literature and Government reports, Dekkers and De Laeter (1983) attributed the enrolment trends in science in the seventies as being due to the interplay of four main factors:—

- Increases in the number of subjects. Taking into account non-matriculation subjects, the number of upper school subjects has more than doubled in each State over the past decade.
- Relative difficulty of subjects. In general, students consider science subjects more difficult than those in the social sciences and arts.
- Interest and enjoyment of a subject. These aspects have been shown to be a significant factor in student choice.
- Career relevance of a subject. It has also been shown that there is an increasing tendency for students to choose a subject that has potential career relevance.

As well as the foregoing factors, the growth and the changing composition of the Year 12 school population is now having a considerable impact on science enrolment trends. Increases in the retentivity of students in Year 12 first became obvious in the 1960's and gathered momentum in the late 1970's through to the 1980's. Since 1970 the Year 12 population has nearly doubled, with the most pronounced retentivity being for females (26.1% in 1970 and 49.4% in 1985). In addition, there is now a greater range of abilities and aspirations in Year 12 students than existed in the 1970's and this has also impacted on enrolments.

### Mathematics

Rosier (1980) noted that the specialist mathematics courses *(Type 3)*, have traditionally attracted a higher proportion of male students partly because more males have undertaken careers in engineering and the physical sciences. He surmised that the increased availability of non-specialist mathematics courses contributed to the increasing proportion of female students studying mathematics in the last two years of secondary schooling. An examination of the data in Chapter 2 reinforces these views. The swing to the *Type 2* courses, clearly demonstrated in Figure 14, might be interpreted as a tendency for the secondary student who is required to choose his or her mathematics course two years before completing Year 12 studies, to leave the options open as far as choosing a career is concerned. The parallel but less accentuated trend in the *Type 1* courses, illustrated in Figure 14, is due, at least in part, to the availability of the less-specialised mathematics subjects for an increasing number of students.

The Queensland Board of Secondary School Studies Report (1985) listed the following factors as contributing to the lower participation rates in the more rigorous traditional mathematics subjects:-

- The declining popularity of subjects reputed to be intellectually rigorous (STEP, 1980).
- The quest for relevance by students who saw their future in commerce or technology (STEP, 1980).

- The question of electives and core which saw students drop or change subjects at Years 11 and 12 without realising the impact such changes could have on future job opportunities (STEP, 1980).
- Sex differentials in job opportunities for females. While more females than males satisfied tertiary entry requirements, females tended to concentrate on subjects that were not technologically oriented. More than 25% of the male students satisfied tertiary entry requirements with two mathematics subjects, physics and chemistry compared to 6% of the female students. Again, about 45% of male students satisfied the requirements with a general mathematics subject, compared to about 20% of female students (STEP 1980).
- Time spent on mathematics. Females in Australia spent less time than males learning mathematics.
- Attitudinal factors differentiated between those students who continued with mathematics and science into upper school and those who did not. Leder (1977) showed that in Australia, female students in particular needed to be made aware of the factors which contributed to mathematical reluctance and counselled towards more positive, confident, vocational orientations; and
- Teaching methods in mathematics and the sciences which have been severely criticized for being too abstract, too remote from the experience of the learners, irrelevant, and not person-oriented.

The arguments in the STEP Report (1980), which have been echoed by others (e.g. Badger, 1981; Moss, 1982; Jones, 1983), have been that the relatively low level of success and lack of attraction to mathematics among females may be related to their perception of mathematics as a male domain. An associated hypothesis is that the move away from the sex stereotyping of employment opportunities in mathematics, (along with most other forms of employment tasks), has meant that females are no longer deterred from attempting to achieve their potential in what was hitherto a male domain. Consequently, females have developed an increasing estimate of their own ability at mathematics and are sufficiently interested to study the subject.

Apart from these contentions, it is suggested that the impact of the computer has contributed to the trends, although the provisions for computer studies are not available at the Year 11 or Year 12 level in every State, let alone every school. The fact that computer studies is more often made available in the *Type 1* or *Type 2* courses (for example, *General Mathematics* in Victoria, *Mathematics IV* in Western Australia) is seen as a drawcard for this type of course, as students realise the impact the computer has in an increasing number of jobs and professions. It will be interesting to observe the effect of the increasing number of computer studies subjects on these mathematics units.

Another reason for the swing to the less specialised mathematics courses in preference to those included in the *Type 3* category might lie in the steady growth in business education at the tertiary level (STEP, 1980). As society becomes increasingly aware of the role that mathematics has to play in all areas of business - in accounting, economics and finance - so the student looks for the mathematics most appropriate for his or her future needs. In this respect the more specialised mathematics courses are frequently labelled as inappropriate by both the student and the employer, for the latter now has a tendency to be more discerning in the entry qualifications placed on a particular employment area. In addition, many of the most able secondary students opt for careers in medicine and law which, though requiring high tertiary entrance standards, do not insist on a specialised mathematical prerequisite. Dekkers and De Laeter (1983) note that, as a result of this phenomenon, the technological professions are failing to attract the more talented students. Thus, in the long run, there will be a dearth of appropriately qualified graduates to enter those fields of study which would enable Australia to compete in an increasingly technological world. Consequently there is a need to encourage more students to enter the technological professions, along with a complementary aim to increase the mathematical literacy of the majority of secondary school students.

## 4.4 IMPLICATIONS OF THE TRENDS

### Upper Secondary School

It seems inevitable that the above factors will continue to influence science and mathematics enrolment trends for the remainder of the 1980's and beyond. Furthermore, the retention rates to Year 12 will continue to increase for some years to come (based on Australian Bureau of Statistics population projections), though not necessarily at the rate experienced in the past few years.

Based on present enrolment trends for chemistry, physics and geology, there is little cause for optimism that the present proportion of Year 12 students in each of these subjects will increase. This is not the case for biology enrolments which have kept pace with the relative increases in the Year 12 enrolments. A number of indications give support to the above predictions. Firstly, each State education system has responded in their own way to the changing nature of the Year 12 school population. This being so, there is a commonality in approach in so far that in each State there has been a broadening of the Year 11 and 12 curriculum in order to cater for the broader range of student abilities and aspirations. One way that this is being achieved in each State is through the increased provision of non-matriculation upper school subjects. This approach has had considerable impact in the ACT, South Australia and Victoria to the extent that an increasing percentage of Year 12 students are taking non-matriculation subjects and thereby depleting the pool of students seeking entry enrolment n degree courses at tertiary institutions.

Over the past three decades a number of efforts have been made to attract more students into science subjects. There is little evidence, with the exception of the Web of Life Biology course, that Australian curriculum development projects have been successful in attracting students to do matriculation science. However, Chapter 2 presented concrete evidence that the introduction of alternate science subjects such as Physical Science and Multidisciplinary Science, has considerable appeal. Also in both NSW and Victoria, an increasing number of students are enrolling in non-matriculation science subjects. Perhaps the introduction of these subjects will stem the "drift" away from science and will help to meet the needs of science and technology-based industries.

The enrolment data in Chapter 2 reveal that upper school mathematics enrolments are riding on the crest of an upward-swinging curve paralleling the Peer-Year-12 population curve. This phenomenon has been in evidence over the past ten years and appears set to continue for many years to come, for, as enrolments drop in one area of mathematical study (*Type 3* units) they are picked up by one or another area. Not that this avoidance of the more rigorous mathematics units (mainly by females) is any reason for complacency.

ıquestionably the availability of a wide range of mathematics courses at the Year 11/12 level in each Australian State augers well for this country. Unlike the situation existing in upper secondary school science, where a range of single discipline-specific courses are available, (one course in chemistry, one in physics and so on), the wider type and function of mathematics courses offered means that each student is able to select from as varied a menu as is possible. Presumably then, the overall standard of both mathematical literacy and numeracy of the upper secondary school matriculant should steadily improve, since increasing numbers are studying some type of mathematics in their final years at school.

### Tertiary

The proportion of students proceeding from the final year of school to tertiary education has also increased in recent years with approximately 43% of those students completing Year 12 in 1984 entering tertiary education. Although this is an encouraging trend, Australia still lags behind her major international competitors in terms of retention rates at school and the flow through to higher education.

The dramatic increases in the retentivity of Year 12 students in Australian schools have made a considerable impact on the demand for places in tertiary institutions. Already the demand for places has been greater than the supply, as growth in tertiary enrolment has failed to keep pace with growth in the Year 12 population. The implications for enrolments in engineering and science are quite complex, however it seems that the more academically-able students are accepting places in medical or paramedical courses, and many of the more able students with strong backgrounds in science are enrolling in computing or computer-based courses.

The use of microcomputers and the prerequisite skill of mathematical 'know-how' is posing new challenges to the secondary schools preparing students for tertiary study. Computers have the potential to improve productivity and consequently the demand for computer- related courses will accelerate in the tertiary education sector. The Australian Education Council Report (1985) reveals that in the TAFE adult education stream, computer courses and units in micro- electronics are attracting the highest enrolments.

To meet Australia's need for excellence, creativity and innovation in its science and mathematics community, we must develop and utilise the talents of all Australians, including females and other minorities currently under-represented in the science and engineering professions.

## 4.5 CONCLUSIONS

A quiet revolution has been underway in secondary schools over the past decade, and it behoves us to have an understanding of this phenomenon. Although the female Parent-Year-8 population is less than the corresponding male Parent-Year-8 population for each year from 1966 to 1985, a significant change has occurred in the Peer-Year-12 population. Prior to 1977 the male Peer-Year-12 population was always greater than the corresponding female population, but since 1977 the trend has reversed, so that the female retentivity has exceeded the male retentivity with respect to the final year of secondary education from 1977 to 1985. In 1985 49.4% of the incoming 1981 female Parent-Year-8 group remained at Year 12, whereas only 43.4% of the 1981 male Parent-Year-8 population was still at school.

This dramatic increase in female retentivity (of 84% over the past 15 years), is the single most important factor in determining science and mathematics enrolment trends over this period of time. In that sense it is similar to the situation which occurred in the United Kingdom in the 1960's. The "swing" away from science as portrayed by the Dainton Report (1968), was not against science *per se*, but away from a range of subjects which require cumulative learning and are therefore considered by students to be difficult and demanding.

It is interesting to note that when this study commenced several years ago, male-female statistical information was requested from the respective State Educational Authorities for science and mathematics subjects, but some States did not possess the data-base to enable such information to be provided. A side-benefit of this study has been the increased awareness of the importance of knowing the facts about male-female enrolment trends before an understanding of mathematics and science enrolment trends is possible.

The other major factor which has occurred over the past 16 years has been the significant increase in retentivity of the Parent-Year 8 population remaining to Year 12. In 1970 the total retentivity was 30% as compared to 46.3% in 1985. This increased retentivity implies that students with a much greater range of background and ability are now remaining at School to Years 11 and 12, as compared to 16 years ago. It is also interesting to note the wide disparity in retentivity between the various States. The Australian Capital Territory had a retentivity of 77.7% in 1985, the next highest being Queensland with 55.1%. Perhaps it is pertinent that neither of these States have a Public Examinations system in the same way as do the other States.

The increasing numbers of students in the final years of secondary schooling has highlighted the fact that many students are not prepared to enrol in some science and mathematics subjects which have the reputation of being difficult and demanding, and/or require a solid grounding in basic mathematical or scientific information. It has long been recognised (e.g. Dow 1971), that the numbers in chemistry and physics were not increasing at the same rate as the upper school student population, and the same situation pertained to the more demanding mathematics subjects.

Educators have responded to this situation by introducing a variety of new mathematics and science subjects which have attracted a healthy clientele. It would seem that in those States which offer a greater selection of mathematics and science subjects, there is a greater response by students who possess a wide range of academic ability and background. A particular case occurs in the Australian Capital Territory which has the highest retentivity of all the Australian States, and also has the greatest number of options from which to choose.

The past decade is therefore characterised by a diversification of mathematics and science subjects to cater for the increasing number of students of variable ability and background who are remaining to Years 11 and 12 of secondary schooling. This development has important ramifications to one of the objectives of science and mathematics education, namely the improvement of scientific and mathematical literacy amongst the citizens of a technological society.

A specific case of this diversification has been the introduction of computer studies in secondary schools. In some States computing was introduced into schools by mathematics and/or science teachers, but there is now a growing awareness that computing is a discipline in its own right with important applications to all fields of endeavour. Certainly it is a subject which attracts young people, although in some cases software and hardware provisions have not kept pace with student demands. Nevertheless, computing will undoubtedly attract a larger number of students than at present, along with other subject options which will be introduced in the future.

Another feature of the enrolment trends over the past 16 years has been the steady decline of geology. In this monograph geology has been treated on the same basis as biology, chemistry and physics, but in reality it is now a minor subject in terms of student enrolments. The introduction of the Australian Academy of Science geology course in the late 1970's caused a temporary halt to the decline in student enrolments, particularly in South Australia where the course was initiated, but there has been a subsequent decline in the subject. In reality, there are now only three major science subjects - Biology, Chemistry and Physics - and an increasingly large number of minor science subjects of which Geology is a member. It could well be that subjects such as Human Biology, Physical Science and General Science may become as important as "major" subjects in the next decade. Certainly Human Biology has already achieved this status in Western Australia. It is disappointing to note that the Australian Academy of Science curriculum projects in biology, chemistry and geology do not seem to have made a lasting effect on student enrolments in these subjects.

The situation in science at the secondary level is mirrored at the tertiary level. A number of studies have reported the enrolment pattern in Biology (Stern and Burchett, 1979), Chemistry (Stern, 1981), Geoscience (Berkman, 1980) and Physics (Jennings and De Laeter, 1984). Whereas total tertiary enrolments have approximately doubled over the past decade, enrolments in the physical and geological sciences have not kept pace with this overall increase. The same trend is evident in engineering which requires a strong background in mathematics and physical sciences. For chemistry, enrolments at the third year tertiary level have remained essentially constant over the period 1968-1981. However, in the biological sciences there has been an approximate doubling of numbers in tertiary institutions over the past decade, reflecting to some extent the increasing popularity of biology at the secondary level.

For the tertiary-education sector, an implication of the present science enrolment trends is that it seems unlikely that the enrolment pattern for studies in the physical, chemical and geological sciences and engineering will change significantly in the foreseeable future.

It is necessary to comment further on the dramatic increases in female mathematics and science enrolments during the last decade. The trend in female enrolments is affected by at least two additional factors. Firstly, there is evidence of increased opportunities for females to take mathematics and science at the upper secondary level, particularly in the all-female secondary schools. Secondly, government, private enterprise, teachers and career officers are now encouraging more females into scientific and technological oriented careers. In addition, selective attempts have been made within Australian schools to encourage females to broaden their occupational and career horizons.

Despite these efforts a considerable proportion of females in Year 12 concentrate on non-science and non-mathematics subjects. This has been clearly highlighted in the Myer Report (ACITCA, 1980):

> *"More than 25% of boys satisfied tertiary entry requirements with two mathematics, physics and chemistry, but only 6% of girls do so; about 45% of boys did so with at least general mathematics, compared with less than 20% of girls."*

This conclusion is in agreement with the data presented in this study which indicate that for the physical science enrolments in each State, male enrolments outnumber female enrolments by approximately a factor of two. Thus few females enrol in engineering studies at tertiary institutions and efforts are now being made by CSIRO and other concerned organisations to encourage a greater proportion of females to enter the applied sciences. However this encouragement implies the necessity of more females opting to study the more demanding mathematical and physical sciences at school.

The mathematics and science enrolment data reported in this monograph have implications for the scientific and technological future of Australia. We see that, at a time when there is a growing realisation of Australia's dependence on overseas technology, and a recognition of the problems of bringing new technology into the workforce, the enrolments of students in the physical sciences have remained relatively static, whilst the proportions of students at Year 12 studying chemistry and physics have declined. Many of the most able secondary school students opt for careers in medicine and law, whilst the technological professions are failing to attract the most talented students. There is a need to encourage more students to enter those fields of study which can enable Australia to compete in an increasingly technological world, and to establish some of our tertiary institutions as first-rate technological establishments capable of attracting students of high ability. A complementary aim must be to increase the scientific and mathematical literacy of the majority of our secondary school students. This implies the need to cater in a more appropriate manner for the wider range of abilities which now exist in the upper secondary schools. The evidence presented in this study suggests that this is being accomplished to an increasing extent, and this trend is likely to continue. We consider that science subjects should include topics that examine the economic, social and environmental implications of contemporary science.

The Australian Academy of Science has made a significant contribution to the reform of science curricula in Australian schools. Likewise, science teachers and their professional bodies, such as the Australian Science Teachers Association, have a vital role to play in ensuring that the content and approach to science instruction meet the needs and aspirations of all students as do the corresponding Associations in mathematics. However, curriculum reform alone is not sufficient to increase the pool of enrolments. If students are to be attracted to mathematics and the sciences, in the ultimate hope of better catering for present and future manpower needs for science and technology, action is also required from teachers and teacher organisations in conjunction with professional Associations of scientists and engineers, at state and national level. If Australia is to sustain its position as a developed country, it is essential that young people should be acquainted with the variety of careers in mathematics, science and engineering at professional and paraprofessional levels and with the importance of a skilled technological workforce to meet the challenges of the future

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